SYMPOSIA OF
THE SWEDISH NUTRITION FOUNDATION
IX

FAMINE

A Symposium dealing with

Nutrition and Relief Operations in Times of Disaster

ALMQVIST & WIKSELL / Stockholm / Sweden

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A SYMPOSIUM DEALING WITH

Nutrition and Relief Operations in Times of Disaster

EDITED FOR

THE SWEDISH NUTRITION FOUNDATION

AND

THE SWEDISH INTERNATIONAL DEVELOPMENT AUTHORITY (SIDA)

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OPENING REMARKS

by Bo Vahlquist

On behalf of the Swedish Nutrition Foundation and the Swedish International Development Authority it is my privilege and pleasure to extend a hearty welcome to our distinguished guests from far and near. We are glad that so many, who represent also so many international organizations, have accepted our invitation.

There is no need to explain why the topic of this symposium has been chosen. Disasters involving large population groups continue to be a threat to mankind, be they man-made or nature's work. More often than not, hunger and starvation are part of the overall sad picture of disaster.

The developing countries are more vulnerable in this respect than the technically developed ones. But let us not forget that in Europe in times past the ravages of severe famine occurred, even at times when wars were not being waged. I shall quote some lines from the diary of a Swedish clergyman in the seventeenth century:

"In this very year prices were high both in Sweden and in Finland since crops had failed. From many a place reports arrived that people were dying of starvation and that they had to use as food boiled leaves, twigs and other unsuitable material. Beggars were everywhere and so multitudinous that nobody could tell their number. At the house entrances crowds of children and poor people were crying for help in the name of God."

Science has increased infinitely our knowledge of human nutrition and taught which are the nutrients essential for life and wellbeing and what are the minimal needs of these nutrients. Likewise, modern agriculture and technology have created new dimensions in production and preservation of food and in speed and safety for transport of goods over long distances. Yet, confronted with the intricate and complex practical problems in disaster areas, relief operations still may meet with almost unsurmountable difficulties and prove sadly inefficient to cope with the needs of all those afflicted.

The aim of this symposium is to establish contact on a broad basis between nutrition scientists with experience from hunger stricken areas and representatives from international organizations which are engaged, time after time, in relief operations. There will probably never appear any blueprint to guide behaviour in all situations. We hope nevertheless that the result of the deliberations and the discussions to follow during the next few days, and especially the brain storm of the three working groups on Wednesday, will lead to recommendations of value for further action. Because, unfortunately, there will almost certainly be a need for future action, since in many areas of the world the widening gap between "production and reproduction" will increase the risk of recurring famine periods.

Whether this view be too pessimistic or not, there is obviously a great need for *preplanning* in relief work. For those of the international organizations which are already working on such plans we hope valuable aspects will emerge as a result of our meeting.

This symposium is the ninth in an annual series which started under the auspices of the Swedish Nutrition Foundation in 1962. The topic of the first symposium in Båstad was "Mild-moderate forms of protein-calorie malnutrition". The topic of this symposium again has a special bearing on problems of developing countries and we are glad that therefore the Swedish International Development Authority (SIDA) has agreed to act as a co-sponsoring agency. We see in this an expression of the fact that SIDA is continuously giving increasingly serious emphasis to nutrition in its action programmes. In the developing countries, even without acute disasters looming, hunger and malnutrition are constant but silent accompaniments to large populations groups and especially to children.

CAUSES OF FAMINE IN THE PAST AND IN THE FUTURE

by B. M. Nicol[1]

Mr Chairman, when I studied the title of this Symposium, and particularly the subject upon which I have been asked to speak: "The Causes of Famine in the Past and in the Future"—I was somewhat perturbed. Apparently I was to have the gifts of an ancient seer as well as those of a soothsayer foretelling events still to be unfolded while being deprived of any substantial presence. I wondered if the past had been so bad and the future was going to be so good, that the present was, in fact, immaterial. But the possibility of future famines seemed to be implicit in the suggested subject. My real problem was to know whether "disaster" and "famine" should be defined as acute episodes in the affairs of men, past or future, or if they are not a continuous state of affairs which are always with us.

So I consulted the Oxford English Dictionary (OED) (1). "Disaster" has two main definitions: (*a*) an unfavourable aspect of a star or of a planet—and this need not concern us; (*b*) anything that befalls of ruinous or distressing nature; a sudden *or* great mishap, misfortune or misadventure. The suddenness is qualified because a great mishap may, presumably, have continuing effects. Definitions of "famine" in the OED are as follows: (*a*) "extreme and general scarcity of food in a town, country, etc.; (*b*) an extreme dearth or scarcity of something specified, material or immaterial; (*c*) want of food, hunger; hence starvation". A now obsolete English verb in its transitive sense used to mean "to distress with famine; to kill or subdue with hunger; to starve, or intransitively, to suffer or die of hunger, to starve".

Thus I believe that famine and starvation, about which Dr Aykroyd will speak to us soon, are synonymous. The word starvation was apparently first used in the House of Commons with reference to the bill of 1775 "for restraining trade and commerce with the New England Colonies which the opposition denounced as intended to combat the rebellion by providing a famine in which the innocent would suffer equally with the guilty". This is an example of a past attempt to cause famine for political ends which is unfortunately still being used in times of rebellion with varying degrees of success or failure.

There are only two other definitions of the English verb to starve to which I would draw your attention and they come from a dictionary published in Scotland (2). They are (*a*) "to starve to death of cold", and one can do this very quickly, even when well-fed, if it is cold enough and (*b*) "to starve to cure", a therapeutic misconception enshrined in English in the expression "feed a cold and starve a fever". This practice is applied in many developing countries and most of us here have seen the dire results about which Dr Whitehead and Dr Viteri will be talking later.

But one can starve to death not only as a result of lack of food. Lack of specific nu-

[1] Deputy Director, Nutrition Division, FAO, Rome.

trients can have the same effect. Pirie (3) describes the plight of the prospectors for gold in Southern California, now famous for its citrus fruit, who, little more than 100 years ago, suffered acutely from scurvy and 100 000 people are said to have died there of it. The mortality of infants in South East Asia as a result of thiamine deficiency is another example.

A formidable list of past disasters and famines which have occurred in all the regions of the world is given by Cépède and Lengellé (4). From the beginning of the Christian era the British Isles, France and the Germanic States appear to have had a famine or serious food shortage every 2 or 3 years until about 1870. In Bohemia, Poland and Austria the same seems to have been the case. In Russia and the Ukraine they continued until about 1933. Ireland does not seem to have been as badly hit over those 1900 years as England, Scotland and France although the potato famine of 1845--1847 was of great severity. China is reported to have had 1828 famines in one or another part of the country between 108 B.C. and 1929 A.D., or 90 famines in each 100 years.

I have not been able to find a definition of famine in the book by Cépède and Lengellé so it is difficult to know the extent of the disasters to which they refer. But some data are given. For instance in Italy in 1347 two-thirds of the population is reported to have died. In 1438 one-third of the population of Paris died and in the same city 100 000 died during a period of 3 months in 1592. In London 20 000 died in 1257–1258. More recently 168 000 are said to have died of famine in 1770 in Bohemia and Poland. Lovelady, quoted by Cépède and Lengellé, says "it would no doubt be possible to find local harvest shortages and the resultant hardships, in one or other parts of the Far East, every year", a state of affairs I found for myself in Nigeria between 1946 and 1960. There is a distinction drawn between "famine" and "disette" by Cépède and Lengellé which is a true one but even shortage of the harvest can produce starvation in the economically and sociologically underprivileged, particularly in the physiologically vulnerable sections of an afflicted community.

Only a few causes are given for the many famines listed by Cépède and Lengellé. They include the "micla hunger" in England in 975; "pénurie" in England for 23 years leading to famine in 1286; the black death in France in 1348–1349; "gelées, peste, orages" in France 1362–1365; "famine dans l'armée des croisés" in 1250; drought in England and France from 1135 to 1137; "mal des ardents; feu sacré" in England and France in 1358, which I am told indicates ergot infection of wheat, rye or barley and the clinical manifestations of ergotism, though which comes first, poor cultivation leading to the infection or ergotism leading to inability to cultivate, I would not know. Possibly, Professor Mayer can enlighten us.

In addition to such causes of past episodes of starvation must be added the ever underlying fact that until recently people depended for food on crops produced by themselves at no great distance from their homes. When crops failed they starved in greater or lesser degree. This situation still exists in much of the developing world. Under such circumstances the socio-economically privileged fare best. But even though crops do not fail and are available in average quantities inequitable distribution of food between socio-economic groups and also within families can lead to hunger or semi-starvation for some members of such

TABLE 1. *Ratio of energy and protein intakes (I) to requirements (R) of children 4 to 6 years of age compared with those of adults in the same families (Nigerian peasant farmers).*

SPA = safe practical allowance.
MR = minimum requirement.

Vegetation zone	Calories per day I/R × 100		Protein, g per day I/SPA × 100		I/MR × 100	
	4–6 yrs	Adults	4–6 yrs	Adults	4–6 yrs	Adults
Sahel Savannah	87	128	220	240	330	360
Sudan Savannah	95	110	190	200	280	300
Guinea Savannah	70	115	200	250	300	370
Montane	75	100	170	200	250	300
Rain forest	77	95	70	90	105	130
Derived savannah	70	87	70	76	105	110

communities. Table 1 gives an example from Nigeria. When adults consume diets providing between 100% and 130% of their estimated calorie requirements, based on FAO/WHO estimates (5) (6), children aged 4 to 6 years are only given enough food to provide between 70% and 85% of their energy needs. In areas where adults' diets provide between 200% and 240% of their protein needs in terms of safe practical allowances, derived mainly from sorghum, millet and grain legumes, the diets of children of the same age provide between 170% and 220% of their protein requirements. But in those areas where roots and tubers are the staple crops and adults consume only a little more than their safe practical allowance for protein, children aged 4 to 6 years ingest only 70% of their needs (7).

An example of distribution of nutrients between socio-economic groups is given in

TABLE 2. *Nutrient intakes of different socio-economic groups in Nigeria.*

NA = native authority.

Nutrient (intake per day)	Niger Delta (freshwater and mangrove swamp)		Bida area (Guinea Savannah)	
	Traders	Fishermen	NA officials	Farmers
Calories	3 000	2 200	3 200	2 600
Protein (g)				
Animal	50	24	45	5
Total	84	50	90	75
Fat (g)	86	39	50	44
Vitamin A (i.u.)	9 000	5 700	8 000	5 000
Thiamine (mg)	1.02	0.30	3.60	3.20
Riboflavine (mg)	1.37	0.68	1.20	0.76
Ascorbic acid (mg)	71	40	100	98
Calcium (g)	1.3	2.9	1.3	0.5
Iron (mg)	21	24	56	40

Table 2. In the Niger Delta the small-town traders ate considerably better than the local fishermen; in the Guinea Savannah area native authority officials ate much better than the local farmers.

I believe that such data provide evidence of a present and continuing state of hunger or semi-starvation, particularly among the younger age-groups of the underprivileged classes in many developing countries to-day which is as important, if not more so, than the acute situations described in Masefield's admirable book, "Food and Nutrition Procedures in Times of Disaster" (8).

"What men eat and drink is shaped not only by cooking techniques and equipment but by agriculture and animal husbandry, by the availability of water and fuel, by knowledge of botany, biology and the ecology of plants, insects and animals. Success or failure in the quest for food has dictated population growth and urban development as well as economic, social and political theory. And the quest itself has been the catalyst of exploration, trade and technological development" (9). Such knowledge has been gained and applied with some success in the last few decades so that famines and starvation of the sort listed by Cépède and Lengellé now occur less frequently. Since Harrison tried and failed in 1873 to use refrigeration to ship meat from Australia to Britain, transportation of perishable foodstuffs around the world is now possible. Surpluses of food arising intentionally or unintentionally in certain regions can be, and are being, put to use for social and economic development in the third world through well-conducted bilateral governmental action and through the UN/FAO World Food Programme. The difficulties associated with such programmes are being surmounted, albeit with some difficulty. As Alan Berg pointed out to the Protein Advisory Group meeting in May this year ninety million people in Eastern India, in 1966 and 1967, were trapped in the worst drought in post-independence India. The world press predicted a vast natural disaster involving millions of starvation deaths. Fortunately the forecast proved wrong. The India Government mobilized a massive relief programme and, aided by substantial quantities of food from the international community, was able to hold the line until the next monsoon.

What can I say of the future in my role as soothsayer? I can quote Davidson and Passmore (10) as follows: "To overcome poverty in rural areas new methods of animal husbandry, the increased use of irrigation and fertilizers and the introduction of new varieties of seeds for the main crops are needed. Only a social, educational and economic system that provides employment and a fair wage for all sections of the working population can prevent large numbers of children dying from malnutrition." With great respect for Sir Stanley Davidson, whose student, houseman and registrar I was, and for my friend Reg Passmore, from the point of view of an international civil servant I can only exclaim "easier said than done". But of course they are right.

From the international point of view FAO put together in 1964 a team of agronomists, economists, nutritionists, demographers and sociologists to draw up a Provisional Indicative World Plan for Agricultural Development (IWP) (11). Presented at the Second World Food Congress at The Hague in June 1970 the IWP analyses the main issues which will be facing agriculture in the 1970's and 1980's and suggests the most effective ways in which they can be resolved by national and international action. It provides data for production, consumption and trade objectives projected to

TABLE 3. *Energy and protein supplies (S) and requirements (R) by region in base years (1962–1964) at per caput level.*

Region	Calories (per day)			Protein (g per day)[a]			
	S	R	S/R × 100	S		R	S/R × 100
				Total	*Animal*		
North America	3 090	2 710	114	91	64	74	123
Oceania	3 200	2 540	126	93	62	73	127
Eastern Europe	3 020	2 570	118	94	34	—	—
Latin America	2 600	2 380	109	68	25	65	105
Africa S. of Sahara	2 130	2 240	95	58	9	63	91
Near East and N. Africa	2 140	2 340	91	64	13	64	100
Asia and Far East	1 990	2 210	90	51	7	58	88

[a] Practical allowance.

the years 1975 and 1985, based on the year 1962–1964 and on trends in food production and consumption established earlier.

The IWP data in Table 3 are derived from national food balance sheets covering about 80% of the world's population at the base period. It could well be said from these figures that the situation at *per caput* level was not so bad; only a 5% to 10% deficit in calories in Africa, the Near East and Asia; and about 10% deficit in protein expressed as grammes per day *per caput* in Africa South of the Sahara and in Asia. However, such *per caput* figures conceal the inequitable distribution of food within socio-economic and family groups.

How far will food supplies be able to keep pace with the projected increase in demand? Provided the IWP rates of increase in gross domestic product and in food production can be achieved, and they are based on the best assumption which can presently be made, food supplies should be able to cover energy and protein requirements as presently defined by FAO and WHO at *per caput* level in 1985. However they will not quite meet the expected economic demand (Table 4). But I must emphasise again that IWP figures are at *per caput* level and therefore do not take account of distribution of available foodstuffs within populations and communities.

The IWP gives cautious recognition to the advantages hoped for from the new high-yielding varieties of cereals. It also recognises the potential of proteins derived from single-celled organisms as a contribution to animal feed but does not yet consider such sources of protein for human food.

In conclusion, we must accept that natural disaster such as earthquake, flood, drought and tornado will continue. But an international conscience and competence is fast being developed which makes it possible to assist the governments of striken

TABLE 4. *Energy and protein increase during the projected period (1962–1975–1985) in developing regions.*

	Relative to nutrition requirements (%)		Relative to projected economic demand (%)	
	Calories	Protein	Calories	Protein
1962	92	91	—	—
1975	102	99	99	97
1985	110	106	97	94

areas in such hours of need. Also governments in areas ecologically exposed to risk of famine are learning to apply those preventive measures which have been developed through new knowledge and new techniques. Pestilences, afflicting both human beings and food crops, are being brought under control by national and international action. Yet it seems to me that we have a long way to go in socio-economic development before the chronic hunger and starvation resulting from inequities of distribution of available food within countries, communities and families will be overcome.

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Summary of Discussion

Rapporteur: Y. Hofvander

The discussion was opened by *Mayer* who referred to the great plague of 1345–48 in Europe and in which 43 million people are reported to have died. This is the one famous example where a massive epidemic caused a famine rather than vice versa. The death toll was so high in towns and villages that no people remained who could read or write and compile the death list ordered by the Pope in Avignon. One of the aspects of the resulting famine, which was due to shortage of manpower, is of particular medical interest. The weakest people died and these included in particular the lepers. There were roughly 18 000 leprosaria with more than 700 000 patients at that time in Europe. A large percentage of these died of starvation and from then on leprosy ceased to be a major threat in most of Western Europe except for Scandinavia where it continued for a long time afterwards.

Mayer also stressed that there is a sharply perceived difference between chronic starvation which is present in some sections of the population and a famine, and that the people involved are very conscious that something unusual is happening which is of a different order of magnitude from the "normal" famine situation. In particular all sorts of social and political consequences of a wide-spread starvation will appear. It may, however, be difficult to decide at what point people may become conscious of the fact that something unusual is going on. The question of criteria for a famine was further discussed after Professor Aykroyd's paper (see below).

Annan drew attention to recent experience from Central America and Africa and stated that we are bound to see during the next decade, due to political upheavals, mass migration of population across frontiers, thereby depleting the agricultural labour force and reducing even the ordinary production of food. It is difficult to see that Africa and Central America will have settled down politically and socially in the next 10 years and much inter-

national effort may have to be spent on relieving the ill effects of such mass migration and particularly in improving the food situation for these people.

Jelliffe stressed the importance of considering "urban famine" in view of the "disurbanization" which is occurring at such a tremendous rate all over the world and which runs *parallel* with the industrial revolution, but often occurs without industrialization. He further saw a danger in technological complacency—the fact that malaria, cholera, and plague had to some extent been brought under control should not warrant the parallel idea that famine threat will be eliminated in the near future. The side effects of technological successes also have to be borne very much in mind; they may have ill consequences, as witness the development of insecticide-resistant pests and "warfarin"-insensitive rats.

Berg, however, expressed confidence in the potential of agriculture and in the increasing sophistication of technology. He thought that famines in the future would come about only if they were politically induced, for instance, if a country intentionally withheld or prevented food from reaching a certain group of people, as has happened in recent history. He also cited a dangerous situation in which a government, because of political consequences, would be unwilling to face up publicly to the fact that it had famine on its hands. It may be an embarrassment to come forward and admit to the world (and local political forces) a problem of such magnitude and implications. He mentioned a situation a few years ago in which a government with a serious famine was reluctant to turn to other countries for necessary help, because of the unfolding impression it gave. One should not underestimate the political sensitivities of famine.

Ramalingaswami confirmed that migration is a real and massive phenomenon and gave examples from South Bihar in India, where 45 000 people migrated to a nearby industrial area. Those persons who are relatively more fit and capable of walking migrate and leave the older people behind. Relief agencies moving around in jeeps along the main road will thus see only comparatively healthy people and nothing of the starvation in the huts.

Information concerning famine and starvation in the past is usually scanty. *Vahlquist* had screened Swedish History (10 volumes and 3 500 pages) and had found that the only mention of starvation was from the year 1650, although famine is known to have occurred frequently. Undernutrition was dealt with in the same books in only 5–10 lines. It was hoped that present and future information would be more comprehensive.

DEFINITION OF DIFFERENT DEGREES OF STARVATION

by W. R. Aykroyd[1]

The theme of this symposium is nutrition and relief operation in times of disaster, the disaster being lack of food brought about by one or other of the causes mentioned in Dr Nicol's paper, or, frequently, by a combination of these causes. Finding I was called upon to give a paper called "Definition of different degrees of starvation", my first reaction was to object to this title on the semantic grounds that starvation, like death, is something absolute and does not admit of degrees. But on second thoughts I realised that there *are* degrees of starvation, a fact we recognise when we say that people are "half-starved". Actually, relief operations are concerned more with rescuing the half-starved than the wholly starved, who may be beyond help.

The limit of starvation

There is an ultimate degree of starvation at which life in man becomes impossible. This can be expressed in terms of body-weight; it is reached when weight has fallen to about two-thirds of its level in normal health. The first person to give detailed figures about loss of weight in famine was Alexander Porter, Principal of the Medical College, Madras, who published in 1889 a now forgotten but admirable book entitled "The Diseases of the Madras Famine of 1877–78" (1889). Porter was in charge of so-called "famine sheds" in Madras, and during the famine carried out no less than 459 autopsies on patients who had died of starvation. The normal weight of Tamil men, he states, was 110–120 lbs; omitting a number of dropsical cases, the average weight of the famine victims at death was 77 lbs. For women, the corresponding figures were 95–105 and 77 lbs., indicating that the women had lost a somewhat smaller percentage of their body weight when they died. "The majority" Porter says, "had wasted until they were barely two-thirds of their normal weight and when emaciation has reached this degree life is held by a slender thread which the least untoward circumstance is sufficient to snap." The loss of weight affects all the organs and tissues of the body in varying degree. More than 70 % of body fat disappears.

Manifestations of starvation

Many writers over the centuries have given broad descriptions of the results of lack of food. Detailed information on the changes occurring in the starving body is presented in the two volumes of "The Biology of Human Starvation" by Ancel Keyes and his colleagues (1950), this being based on observations on experimental human subjects and exhaustive study of the literature. Here I shall mention briefly only a few major features. The principal phenomenon is wasting or emaciation, an easily observed index of the degree of starvation, though it may be masked to some extent by oedema. Disturbances of water balance, a

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fall in tissue tension and other causes, lead to the oedema which occurs in a high proportion of famine victims. Its prequency and extent are, however, variable, and it cannot be used as an index of the severity of a given famine. It was particularly evident in the terrible Irish famine of 1845–1847 (Woodham-Smith, 1962). Among the reasons for this may have been the establishment of soup kitchens in most parts of the country by Act of Parliament. There were various recipes for the soups, including some devised by the famous French chef, Alexis Soyer; they contained oxheads, maize, turnips, onions, peas, leeks and other ingredients and may have tasted well. But a large bowl of such soup would have provided at most a few hundred calories and would add to the water-logging of the consumers. The authorities and benevolent people were unfortunately convinced that by setting up soup kitchens they were doing the best possible to succour the victims.

In starvation the intestinal walls lose substance like the rest of the body, leading to the common and very serious condition often called "famine diarrhoea". Porter noted what he called "alvine fluxes" in 75% of those dying in the famine sheds on whom he performed autopsies. The intestinal walls are as thin as paper and transparent, with atrophy of the intestinal glands and ulceration. There is frequent passage of copious fluid stools which upsets the water and salt balance, and hastens the occurrence of death. Infective organisms have rarely been isolated in famine diarrhoea; the condition is due primarily to wastage and ulceration of the intestinal walls. Clearly famine diarrhoea is essentially the same condition as the diarrhoea often occurring in marasmic infants.

While the brain is the last of the organs to lose weight, there are important psychological manifestations of continuing lack of food. Among the earliest of these to appear are depression, apathy and loss of initiative, accompanied by obsession with the idea of food. As starvation progresses and becomes extreme, the personality tends to disintegrate with distressing results. I have painful recollections of victims of the Bengal famine of 1943 who had wandered hopelessly from their villages in search of food, thronging into Calcutta and other cities. They were quite disoriented, scarcely knowing where they were or what they were doing, and very difficult to handle. Famine relief workers should not be upset by the mental derangement of those they are trying to help.

Famine and disease

The traditional sequence of the major human disasters is war, famine, and pestilence, all leading to death. Famine has often been associated with outbreaks of disease which have killed more people than starvation itself. But this association is in the main social rather than physiological, i.e., it is due to the disruption of society, facilitating the spread of epidemic disease, rather than lowered bodily resistance to invading organisms. In the Western world typhus has been the most formidable famine disease. In the Irish famine of 1845 typhus, called "famine fever", caused thousands of deaths; circumstances were ideal for the louse and the organisms causing typhus which are transmitted by it. The degree of starvation did not appear to affect liability to typhus, as is shown by the large numbers of benevolent people—doctors, clergymen, nuns, government officials and others—who caught the disease and died of it. "Famine fever" was carried across the Atlantic to Canada and the United States by the miser-

able famine refugees. Today famine is less dangerous to relief workers. In the tropics outbreaks of cholera during famine have been more frequent than outbreaks of typhus. Tuberculosis is usually common and severe in famine-stricken populations; here there is a fairly direct relationship between disease anl lack of food.

Weight loss of lesser degree

A smaller loss of body weight than the one-third recorded by Alexander Porter can be serious enough. In the early months of the Dutch famine of 1944–1945, additional rations were given to people who had lost 25% of their normal weight. As the food situation worsened, the percentage loss of weight calling for supplementary rations had to be raised to 33%. At this point people began to die of starvation. When the loss reached 40%, death was almost inevitable.

In the experimental studies of Ancel Keys and his colleagues, the weight of the volunteer subjects was reduced on the average by 20–25%. This extent of deprivation was enough to enable a great deal of valuable physiological and pathological data on the effects of calorie deficiency to be obtained. It is, of course, the object of famine relief to prevent starvation reaching the point at which it causes death.

Vitamin deficiency

Doctors unfamiliar with famine are sometimes surprised because well-known vitamin deficiency states do not occur in spite of the gross deficiency of the diet. Requirements for vitamins are reduced because of the low level of general and basal metabolism. Scurvy can occur during famine when foods devoid of vitamin C are given for relief; this happened in the Irish famine when the people subsisted for some time on imported maize meal instead of potatoes which contain vitamin C. I have myself seen an outbreak of scurvy during a famine in Central India which appeared after the people had been living for a year or so on cereal grains and almost nothing else. In Japanese prison camps during the Second World War vitamin deficiencies were a more important cause of disability than lack of calories. Calories, derived mainly from milled rice, were insufficient for normal requirements but sufficient to prevent starvation. In such circumstances, if relief is possible, a primary need is for vitamin preparations, as well as for calories.

In general, however, the picture of starvation in sieges and concentration camps seems much the same as that seen in the great famines of history due to loss of food crops.

Deficiency of protein

Vitamin deficiency states, as I have said, are not an important result of starvation. But "degrees of starvation" can be related to deficiency of protein as well as deficiency of calories. A high mortality can occur from lack of foods supplying protein when foods supplying mainly carbohydrate are available to some extent. This mortality affects mainly children, who have relatively high needs for protein. Such a situation is characteristic of tropical Africa, where the staple foods—yams, cassava, plantain, and others—are composed mainly of carbohydrate. As a result of civil war and social disruption, extensive outbreaks of kwashiorkor, a condition due primarily to protein deficiency, have occurred in Africa during recent years. Many thousands of children died of the disease, readily prevented or cured by suitable protein-rich foods.

Assessing degrees of under-nutrition and malnutrition

Apart from ordinary clinical observations, much attention has been given to methods of grading children according to state of nutrition. The simplest is to compare recorded weights with a chosen standard based on normal well-fed children. Various levels of percentage under-weight in terms of the standard are commonly recognised, e.g. 90 to 80%, 80 to 70%, 70 to 60%, 60% and under. Techniques such as skin-fold measurement show the amount of subcutaneous fat present. Various biochemical tests, e.g. the determination of serum albumen, indicate degrees of protein deficiency. But in the emergency of famine the careful recording of evidence of under- and mal-nutrition is rarely possible or indeed necessary. The naked eye—and it may be the eye of a layman and not of a doctor—can provide most of the information needed. When the time for nutritional rehabilitation arrives, periodic appraisals of state of nutrition by suitable techniques are desirable.

Vulnerability of young and old

The vulnerability of children in times of food shortage and famine was not clearly recognised until recently, though it was known—for example in the Irish famine of 1845—that multitudes of children died. The fact that children have exacting dietary needs was not realised. It was noted in India during the nineteenth century that the recorded birth rate fell enormously during famine; this fall, due to both social and physiological causes, would obviously reduce the numbers both of infants and of pregnant and nursing women, another potentially vulnerable group. Throughout most of history the principal measure in preventing and relieving famine was to provide the cereal grain or grains to which the population was accustomed, and no particular attention was given to children. This applies to Joseph's famine in Ancient Egypt, so clearly described in the Bible, and to famines in India and elsewhere down to the twentieth century. In the 1930's a statistical study of mortality in a minor famine in the Punjab showed the preponderance of deaths in children and old people (Passmore, 1951. The old come off badly in famine.

TABLE 1. *Deaths in Hissar, Punjab. Mortality in famine and normal times compared.*

Age in years	1934–38 (annual average)	1939 (famine year)
Under 10	11 033	21 160
10–59	11 378	9 771
60 and over	2 372	6 836
Total	24 794	37 767

The first reference I know of to the value of milk in saving children during famine is to be found in a story by Rudyard Kipling, called "William the Conqueror", in "The Day's Work", published in 1898. In this story, which describes a famine in Madras, hungry people would not eat millet provided by the government. They were rice-eaters by custom. An ingenious relief worker fed some of the millet to goats and gave goats' milk to young children, with excellent results.

Recent developments

After the second world war the provision of milk to children became a prominent measure in relieving food shortage and famine.

The milk was mostly dried skim milk, available until recently in large quantities in the USA as a surplus product. In 1947 UNICEF began to distribute dried skim milk on a large scale to war-devastated countries in Europe. At that time there were still doubts about the nutritional value for children of dried skim milk, which was regarded in some quarters as a useless waste product. In 1947 FAO had to convene an expert committee in Washington to vouch for it. Since that time hundreds of thousands of children in the developing countries have benefited from dried skim milk provided, not only by UNICEF, but by the US government and a number of non-official organizations.

In recent years special emphasis has been placed, in famine relief operations, on foods and food-mixtures which provide children with additional protein and calories. Dried skim milk remains a standby, but today it is commonly given in combination with other foods, as in the excellent American mixture called CSM, which contains maize flour and soya flour as well as milk powder. There is a distinction between the use of dried skim milk and other protein-rich foods in ordinary times in the prevention and treatment of protein-calorie malnutrition, and their use in emergency feeding, though in each case they fulfil the same physiological need. This symposium is concerned mainly with emergency situations. With reference to emergencies, a further distinction should be made; in some of these there may be lack of all foods, in others a relatively more serious lack of foods supplying protein than of foods which are mainly carbohydrate. The most useful type of supplementary feeding may differ according to the nature of the emergency.

Relief

I am taking part in this symposium both in my personal capacity and as representative of OXFAM. OXFAM and other non-official organizations which help to prevent and relieve food shortage and famine are particularly interested in the kinds of food they should supply in times of need. How can they best spend the money given to them by the public for this purpose? No doubt careful attention will be given to this question in our discussions.

OXFAM would welcome the publication of a short authoritative brochure listing the foods and food mixtures which are most valuable in different kinds of emergency, and in different stages of the same emergency. This would list various protein-rich preparations made in various countries; details about food in relation to protein content and calorie yield would be given. It would be valuable to the medical and nutritional advisers of the agencies concerned and could also be consulted by non-medical staff when specialized advise was not available.

A small international planning unit concerned with famine relief might be set up. This would prepare publications of the type referred to above and be associated both with UN agencies and unofficial agencies. It would seek to ensure that famine emergencies were properly recorded, an attempt being made to assess the success and otherwise of relief measures. As things are, much valuable experience tends to be lost.

Summary

Death from starvation results when about one-third of the body weight in health has been lost. Weight loss of lesser degree than this can have dangerous consequences. Among the manifestations of starvation,

seen in famine, are disturbances of water balance leading to famine oedema, diarrhoea, caused by atrophy and ulceration of the intestines, and psychological changes. Epidemics of diseases such as typhus, often associated with famine in the past, are due to social disruption rather than lowered physiological resistance. Vitamin deficiency diseases are rare in famine victims.

"Degrees of starvation" can be related to deficiency of protein as well as deficiency of calories. High mortality in children can occur from lack of foods supplying protein when foods supplying mainly carbohydrate are available to some extent.

Only the simplest methods of assessing state of nutrition can be applied in a famine emergency. Children and old people are the most vulnerable groups, a fact not recognised until recently. The value of dried skim milk and other protein-rich foods, and of suitable protein-rich food mixtures, in safeguarding child life in times of food shortage and famine is now fully realised. Relief agencies need guidance regarding the kind of foods which should be supplied in times of disaster.

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Summary of Discussion

Rapporteur: Y. Hofvander

The criteria for use of the term famine were briefly discussed—"when is a famine a famine?" *Ramalingaswami* pointed out that the chain of events would be drought—scarcity—famine in that order. Since the 1874 drought in India, famine has been declared when the food production in a given area has fallen to 25% of its annual production, initiating a large number of relief measures. This is of course an arbitrary criterion.

Aykroyd considered that it can be said quite simply, that "a famine is a famine". There is no doubt about it when famine is there and it cannot be confused with the ordinary chronic shortage situation or chronic undernutrition and malnutrition in children. Everybody knows it. The relief of chronic undernutrition and malnutrition in children should not be confused with the handling of famines.

Ramalingaswami agreed—there is a sort of aura about a famine which is hard to define but which you feel when you get into a famine area.

Jelliffe suggested that famine is when severe malnutrition becomes epidemic—although this definition does not numerically quantitate it.

There is, however, as was stressed by *Jelliffe,* a need to quantitate the degree of malnutrition in famine circumstances, particularly in young children, for two reasons: (*a*) there is a need for screening in order to ensure that those in the greatest need of food get it first, (*b*) there is quite a surprising absence of detailed statistics of past famines and there is a need for collection of accurate data and statistics which may also be used to evaluate the efficacy of the methods used in dealing with the famine.

What methods should be used? It is of importance that these can be employed also by the non-professionally trained, but they would be the same as those used by the man with the fanciest medical degree. Essentially in young children it will be weight, which may, however, be quite difficult to collect under

these circumstances as this also requires knowledge of the age. Weighing machines may not be easily available or are difficult to transport. Lately, arm circumference has been used in the Caribbean and elsewhere for roughly assessing malnutrition in young children in communities. The advantage is obvious—it is a very simple method and the equipment is simple and easy to transport (only a measuring tape!). The index which measures the muscle and the fat does not alter very much during the second to the fourth year although there is a change in the proportion of muscle and fat. The arm circumference has been used in recent famines in the Congo and in Nigeria by several relief teams and found to be useful and helpful as a guide to where relief efforts should be directed. Essentially the weight and the arm circumference are just elaborations of commonsense observation, because anyone will surely judge which child is most malnourished largely by whether he looks thin or not, particularly whether the arms and legs are thin or covered with muscle and fat.

Mayer verified that a true famine is unlike anything else and is accompanied by the ultimate breakdown of the work structure in an area and sometimes of the social structure. However, methods just mentioned by Jelliffe and which are useful in evaluating chronic malnutrition, are not what you need in the evaluation of a famine. But the need for evaluation of what is going on on a statistical basis is not only important for history but is absolutely essential for the famine relief itself. Unless you have certain criteria you do not know what you are doing. The minute you have a famine situation you have political problems. You will have one group of people who are, if nothing else, politically or emotionally interested in telling you that the situation is worse than it is and another group (usually pro-government) telling you that the situation is better than it is. Without objective criteria you cannot follow what is going on. In practice there are only two criteria which can be used on a massive scale: (*a*) death rate based on data from hospitals in the area or special "famine hospitals: and (*b*) the prevalence of oedema. This may make it a problem to use laymen for collecting these data and interpreting them. One of the problems in recent famines in Africa was that the impressions of laymen of what was going on were very far off the mark, particularly as regards children.

Aall stressed that the difficulties in collecting adequate statistics in famines or in wars arise not only because the situation is so confused but also because of the reluctance of the personnel to record this information and pass it on. Some may refuse because the figures are so shocking that they seem to indicate that what they are doing is inadequate.

He emphasized that it would be of value to combine the data collected by laymen with those obtained by professional people. The last-mentioned are bound to be few and their job would be to organize the collection of data in a systematic way and to guide and teach the laymen.

He also considered it very important to categorize the nutritional needs of the population. In Nigeria an attempt was made to set up a model for this. The definition of a need must also have a practical bearing and therefore the feeding groups that it was attempted to establish in Nigeria reflected what action would be required to meet the needs:

(1) those in need of several meals a day;
(2) those in need of one meal a day;
(3) those in need of a ration a week;
(4) those in need of no extra ration or perhaps only a supplement.

The bulk of the people were categorized into group 3. This group may be 10–100 times greater numerically than those in most need (groups 1 and 2) and if the limiting factor is personnel, it is no use concentrating on the most needy—there will simply not be sufficient time. The distribution of the weekly ration does not require medical personnel. These must concentrate on groups 1 and 2, who are in need of feeding treatment.

In order to carry out such a program a very well organized surveillance is needed and laymen can certainly be taught to register the oedema rate and make weight/height measurements.

Ramalingaswami referred to the problems involved in declaring a famine and also the difficulties in deciding when chronic malnutrition has turned into a famine. The govern-

ment takes a number of factors into account before declaring a famine: In Bihar, there was public clamour, the press was coming in and starvation deaths were high-lighted. There were also counter arguments that the deaths were due not to starvation but to tuberculosis and dysentery.

Hunger oedema is a very dramatic event and attracts attention and can be readily recognized. Death rates are difficult to evaluate. To assess famine one has to take an overall view and use a number of criteria, however imprecise they may be, e.g. death rate, hunger oedema, distress sale of cattle, mortgaging of land, migration of people, petty thefts, food thefts, etc. The whole ecology of famine has to be taken into account. This is a very important and crucial issue in a situation where there is already a significant prevalence of chronic malnutrition. This was also stressed by *Annan* who also urged the Red Cross societies to organize pre-planning in each country, which should include the obtainment of correct non-famine baseline data.

Aykroyd considered that the mortality rate was the best criterion of a state of famine, although reports on this rate usually lagged far behind. The figures do not come in until months later and cannot be used on a day-to-day basis to judge whether things are getting better or worse. The extent of oedema may also vary. In the Irish famine in 1845–48 oedema seems to have been more prevalent than in other famines, for unknown reasons.

Ifekwunigwe reported from the recent Nigerian/Biafran conflict that there was one period in the beginning when there was predominantly kwashiorkor in children and one during the last year when there was predominantly marasmus and when the oedema rate was not very enlightening or helpful. At such times, however, the arm circumference ratio may prove very useful. It is therefore important to decide whether the problem is mainly kwashiorkor or marasmus in children before one can choose the method of measurement.

EFFECTS ON BODY COMPOSITION AND BODY FUNCTION. PSYCHOLOGICAL EFFECTS[1]

by F. E. Viteri[2] and O. Pineda[3]

Famine, or wide-spread scarcity of food, imposes on the individual a nutritional stress situation in which a series of physiological mechanisms must come into play in order to prolong survival. As such they are predominantly adaptative in nature.

During this process of adaptation the organism must necessarily sacrifice some of its own tissues and decrease its capacity to perform non-vital functions. Also, since famine is a stressful situation, it carries a number of psychological effects which alter the "normal" behaviour of the individual as an entity and as part of a complex social organization. All of these changes are subject to modifications depending on the conditions of the host, the severity and length of the food deprivation, and the environmental situation in which famine occurs. These complex effects of famine should be borne in mind in carrying out relief operations.

1. *Energy conservation mechanisms*

Restriction of energy intake below requirements rapidly produces a reduction in energy expenditure and a concomitant mobilization of internal energy sources. Amino acid mobilization may also be necessary for the synthesis of specific proteins in the process of adaptation.

The first of these reactions is achieved by a rapid fall in basal oxygen consumption in starvation (Fig. 1) and a less pronounced decrease in semi-starvation. It appears that this fall in basal oxygen consumption cannot be explained by a concomitant decrease in cell mass; however, in chronic semi-starvation and severe chronic protein-calorie malnutrition (PCM) a greater portion of the decrease in basal oxygen consumption is explained by a progressive reduction in cell mass.

An important role in energy conservation is also attained by a reduction in physical activity. Keys et al. (1950) noted a marked decrease in spontaneous activity in subjects submitted to 24 weeks of semi-starvation. We, on the other hand, have noted a decreased spontaneous caloric expenditure in time motion studies made in Guatemalan peasants whose caloric intake was markedly lower than a similar group whose intake was raised by the administration of a calorie-protein supplement for 3 years, Table 1. It is worth noting that the "poor peasants", as compared with the supplemented ones, not only used fewer calories per minute while working in similar activities, but also rested a longer period of the day. In spite of this, the poor peasants lost weight during the study, indicating, both that they made a special effort to appear

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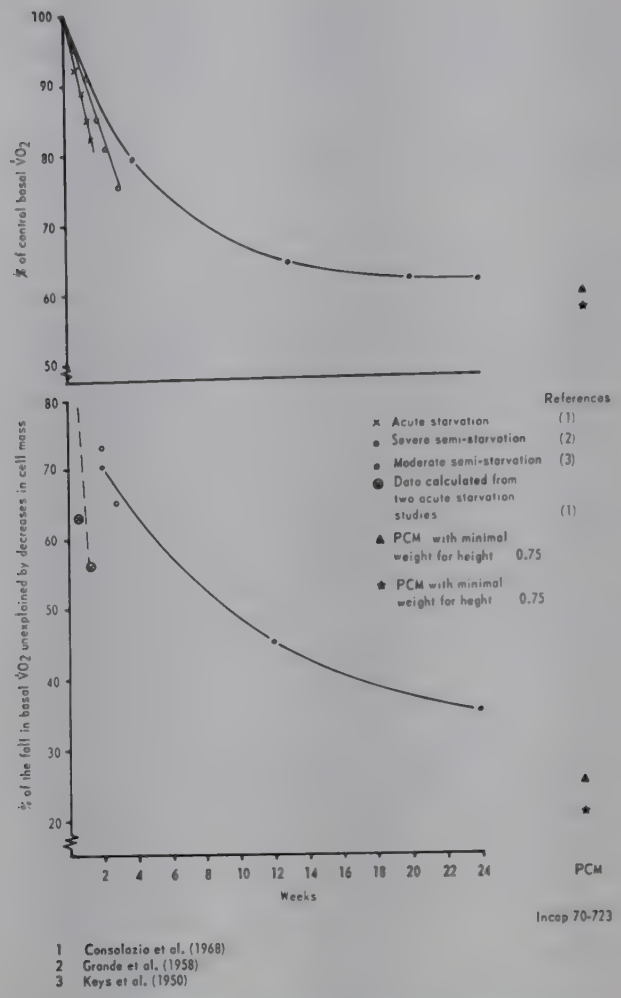
% of control basal $\dot{V}O_2$
% of the fall in basal $\dot{V}O_2$ unexplained by decreases in cell mass
Weeks
References
Acute starvation (1)
Severe semi-starvation (2)
Moderate semi-starvation (3)
Data calculated from two acute starvation studies (1)
PCM with minimal weight for height 0.75
PCM with minimal weight for height 0.75
PCM
Incap 70-723
1 Consolazio et al. (1968)
2 Grande et al. (1958)
3 Keys et al. (1950)

Fig. 1. Decreases in basal oxygen consumption during starvation and semi-starvation. Percent of the basal oxygen consumption decrease unexplained by decreases in cell mass.

more active, and that normally they were even more inactive than appears in the Table.

These two energy conservation mechanisms—decreased basal oxygen consumption and physical activity—have a clear favourable effect in the theoretical time of survival during starvation. Fig. 2 shows, on a per kilogram body weight basis, the caloric value of "reference bodies" for various ages as well as the caloric requirements for human males of the same ages (Viteri, 1970). It is clear that the infant has a greater caloric density, and also a greater energy requirement even if totally inactive. Fig. 3. shows the theoretical survival time to total caloric deprivation for males of various ages, under normal caloric expenditure, total inactivity, and total inactivity when full adaptation in basal oxygen consumption is attained. These calculations show that children are the group most vulnerable to starvation. Pregnant and lactating women are not included in the figures. Herrera et al. (1969) have shown a more efficient adaptation of pregnant rates to caloric restriction; none the less, due to their slightly higher energy requirements, pregnant and lactating women should also be more vulnerable.

The second reaction to starvation, that of mobilization of internal energy sources, and amino acids for synthesis of specific

TABLE 1. *Work output under natural conditions, and caloric intake of Guatemalan agricultural peasants.*

Subjects	Calories				Percent of day		Weight loss (g)
	Intake	Basal expenditure	Available for physical activity	Spent during work (average per minute)	Physically active	Resting[a]	
	(average per day)				(average per day)		(average per day)
Poor peasants	2 693	1 526	1 167	4.6	43	49	−19
Supplemented peasants	3 446	1 594	1 852	5.2	59	33	−125

[a] Includes night rest and prolonged rest during the day, excluding meal time.

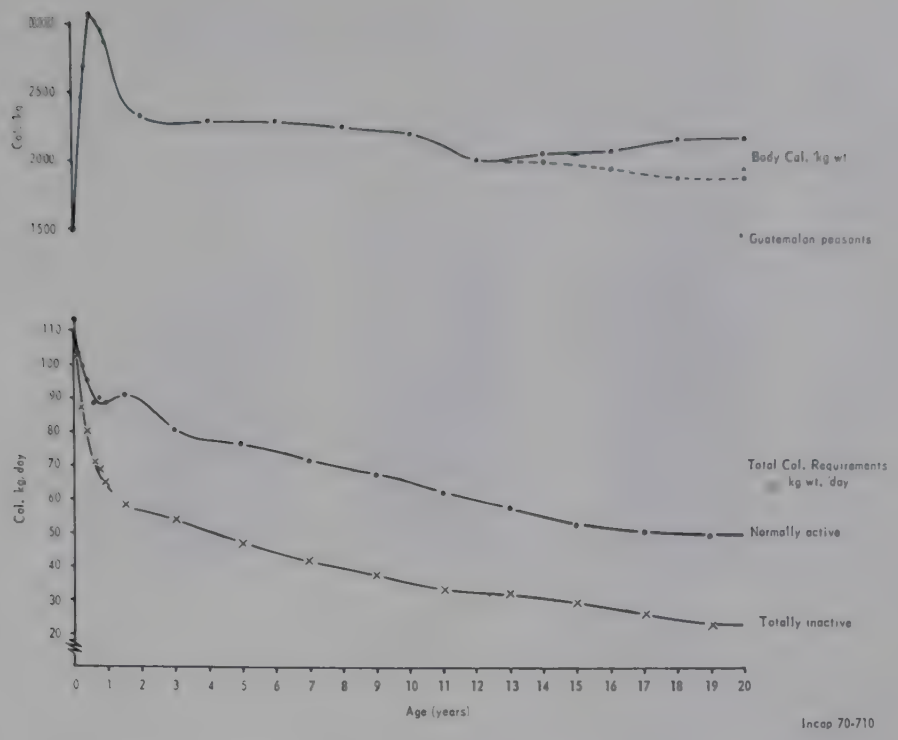

Fig. 2. Body calorie content and caloric requirements at different ages under normal conditions and in total inactivity.

proteins, is normally mediated by the endocrine system by decreasing insulin levels (Cahill et al., 1966; Nitzan et al., 1968) and increasing adrenal steroid production (Castellanos and Arroyave, 1961). Probably an increase in serum growth hormone levels also occurs (Cahill et al., 1966). These endocrine responses produce adipose free fatty acid and muscle amino acid release for energy purposes.

Both newly formed glucose and fatty acids and their metabolites can be efficiently utilized even for brain metabolism (Owen et al., 1967). At present all the evidence indicates that fat is the primary energy source both during acute starvation and chronic semi-starvation.

Body composition studies in man and animals indicate, however, that the mobilization of energy substrates varies depending on a series of host factors. Fig. 4 shows the alteration in body composition in three types of dietary caloric inadequacy in healthy adult males. Acute starvation for 10 days (Krzywicki et al., 1968) produces moderate fat loss, severe "non muscle ac-

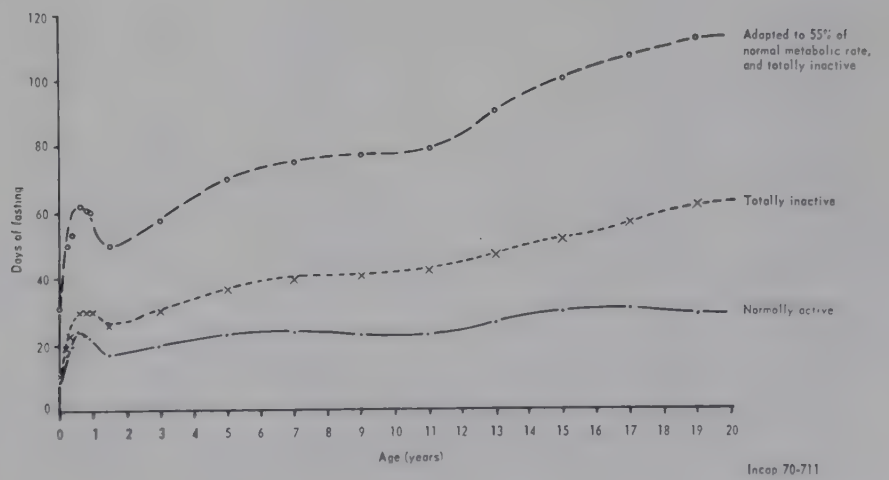

Fig. 3. Theoretical survival time in fasting. Effects of total inactivity and adaptation of basal oxygen consumption in prolongation of theoretical survival time at different ages.

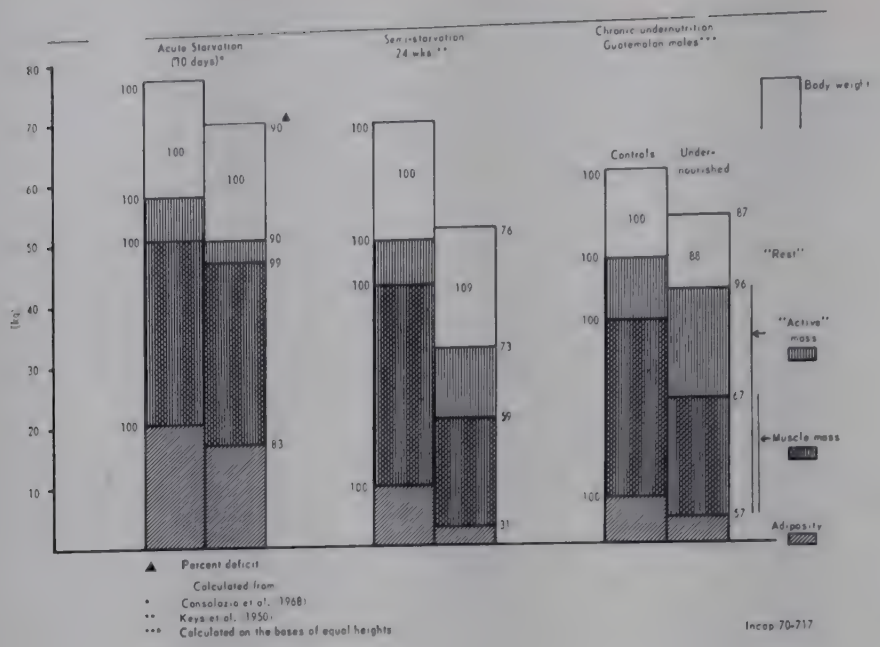

Fig. 4. Changes in body composition during acute starvation, prolonged semi-starvation, and chronic undernutrition.

tive tissue" loss, and preservation of muscle mass. There is a concomitant water loss. By "active tissue" is meant the body compartment obtained by subtracting body fat, body mineral and extracellular water from the total body weight (Keys et al., 1950). Muscle mass is estimated by assuming that 1 g of urinary creatinine in 24 hours represents 18.9 kg of muscle which is an average between Talbot's (1938) and Cheek et al.'s (1965) values. Twenty-four weeks of semi-starvation (Keys et al., 1950) produces a marked fat and muscle loss with preservation of "non-muscle active tissue",

TABLE 2. *Relative reductions in body weight, water, fat and protein caused by undernutrition and starvation.*

Values are % of controls.

Type of animal: rat	Body weight	Water	Fat	Protein
Adult				
Male				
Undernourished	84	88	69	80
Starved	85	85	81	84
Female				
Undernourished	85	93	60	91
Starved	84	90	63	92
Young				
Male				
Undernourished	70	71	66	72
Starved	73	77	39	87
Female				
Undernourished	80	83	67	83
Starved	78	83	47	90

Source: Widdowson and McCance (1956).

TABLE 3. *Body and organ weight loss and protein loss in adult and young animals during starvation and semi-starvation.*

Condition	Time	Body weight	Liver	Spleen	Gastro intestinal tract	Kidneys	Heart	Brain	Adrenals	Muscle	Skin	Skeleton
Adults (% weight)												
Starvation	30 hours	10	18	0	−1	−2	5	2	—	—	2	−2
(guinea pigs)[a]	164 hours	36	35	44	24	11	33	—	—	—	18	3
Starvation												
(rats)[b]	Acute	33	58	51	26	28	5	—	—	31	—	0
Starvation		30	50	52	—	24	23	—	−29	30	—	—
(rats)[c]	Acute	29	55	37	—	30	26	—	−9	19	—	—
Starvation		15	28	33	—	14	10	—	−4	—	—	—
(rats)[d]	Acute	16	18	17	—	12	22	—	21	—	—	—
Semi-starvation												
(rats)[b]	Chronic	36	43	29	57	27	33	7	—	41	—	−2
Semi-starvation		16	20	22	—	24	20	—	−4	—	—	—
(rats)[d]	Chronic	15	21	17	—	19	22	—	23	—	—	—
Young												
Starvation		27	46	50	—	25	12	—	−16	—	—	—
(rats)[d]	Acute	22	23	46	—	17	17	—	−14	—	—	—
Semi-starvation		30	35	25	—	25	25	—	8	—	—	—
(rats)[d]	Chronic	20	32	46	—	25	17	—	21	—	—	—
Adults (% protein loss)												
Starvation												
(rats)[e]	7 days	22	40	—	28	20	18	5	0		8	

[a] Lazzaref (1895).
[b] Jackson (1915).
[c] Cameron and Carmichael (1946).
[d] Widdowson and McCance (1956).
[e] Addis, Poo and Lew (1936).

TABLE 4. *Changes in body weight and liver composition following 8 days of starvation or semi-starvation in rats previously fed to different levels of protein.*

Per cent casein in diet	Treatment	Body weight	Liver weight	Liver (% of body weight)	Protein[a] (mg/g wet weight homogenate)	Protein per liver	Liver fat (mg/g wet weight)
5	Control	120.2±8.1	5.75±0.54	4.8	84.1±1.2	484	124±21
5	Starved	89.7±5.6	3.37±0.33	3.8	119.8±2.6	404	50±15
5	Semi-starved	108.3±6.5	5.75±0.46	5.3	81.3±3.0	431	— —
20	Control	423.3±18.2	16.8±1.0	4.0	116.0±2.1	1 940	35±21
20	Starved	353.0±14.8	10.2±0.6	2.9	116.3±3.4	1 188	60±26
20	Semi-starved	380.7±11.8	13.0±0.7	3.4	116.0±4.5	1 510	— —

[a] $\bar{x}$±S.E. Protein expressed in mg/g of whole liver homogenate centrifuged 10 min at 2 000 g.

and relative body over-hydration. Chronic undernutrition resembles semi-starvation very closely.

On the other hand, the sex and age of the host influences its response to either acute starvation or undernutrition (Widdowson and McCance, 1956). Table 2 taken from the data published by these authors shows that females lose more fat and spare protein in both situations. On the other hand, young animals lose more weight than adult animals during the same period of starvation, the maximal contributor to this loss being fat.

Data published on organ weight loss during starvation by Lazareff (1895), Jackson (1915), Cameron and Carmichael (1946) and Widdowson and McCance (1956), as well as on semi-starvation by Jackson (1915) and Widdowson and McCance (1956) (Table 3) indicate that organ weight losses are very similar in starvation and semi-starvation in the adult and young, regardless of sex. The apparent sex difference in the young may be due to a greater weight loss by the males than by the females (Table 3), the similarities being, in any case, more striking than the differences.

Protein loss from the data of Addis, Poo and Lew (1936) clearly shows that in starvation visceral protein is rapidly lost, in concordance with what was noted from the data of Krzywicki et al. (1968) in adult humans.

The protein nutrition prior to nutritional stress, however, influences the response of the host. Table 4 presents data on the liver composition of two groups of rats submitted to either 8 days of acute starvation or 8 days of only *ad libitum* glucose intake. The prior protein intake was either 20% or 5% casein. The rats on a 5% casein diet have, roughly $^1/_4$ the size of animals of the same age maintained on 20% casein diet. The livers of the 5% casein group are also smaller than those of the 20% casein group, but their contribution to total body weight is greater and remains greater regardless of the type of nutritional stress they are subjected to. These same animals (5% casein), when submitted to starvation increased their liver protein concentration. This does not occur in the 20% casein group.

Two other effects of the previous protein intake are well known: (1) That glucose feeding to the 5% casein group reversed the liver protein concentrating effect of starvation while in the other group of rats the glucose diet had no apparent effect on

TABLE 5. *Effect of diet and starvation on the activity of liver enzymes.*

All assays were made on whole tissue homogenates.

Per cent casein in diet	Treatment	Liver enzyme activity, nmoles/min/g at 25°				
		Fumarase	MDH	IDH	GOT	GPT
5	Control	6.8 ±0.3	187 ±19	9.2 ±0.2	49.6 ±4.3	22.2 ±1.7
5	Starvation	15.6* ±1.4	360* ±52	14.2* ±0.6	150.0* ±3.9	54.0* ±1.8
5	Semi-starvation	6.7 ±0.3	189 ±29	7.3 ±0.3	62.8** ±3.6	20.2 ±0.06
20	Control	11.0 ±0.5	331 ±44	17.8 ±1.5	77.8 ±4.5	31.3 ±4.0
20	Starvation	10.9 ±1.1	278 ±51	14.8 ±0.7	87.7 ±10.7	32.8 ±4.6
20	Semi-starvation	7.3* ±0.5	224** ±12	10.7* ±0.8	66.3 ±8.2	20.6** ±1.2

Difference with respect to control, significant at the 1 % level (*) or the 5 % level (**).

liver protein, and, (2) that starvation reduced the already elevated liver fat in the 5% casein group, while liver fat increased in the animals on the 20% casein diet.

Liver enzyme activity response to nutritional stress is also influenced by the previous protein nutrition. Table 5 shows that starvation in protein-deficient animals causes an increase in the activities of GOT and GPT, as well as in IDH, Fumarase and MDH.[1] The intake of glucose alone does not produce such changes. The activities of the same enzymes in normally nourished rats either starved or glucose fed tend to decrease.

We have interpreted these facts as meaning that the protein-deficient animal is already preconditioned to the further stress of starvation, and as such, enzyme adaptation takes place rapidly. The alterations in enzyme activities suggest a higher rate of amino acid oxidation and increased gluconeogenesis. This last fact is strengthened by the recent finding that in starvation the cytosol GPT activity is increased (Pestaña, 1969).

These animal models will doubtless help to understand the human situation during nutritional stress. In man, in order to gain a clearer insight into metabolic adaptation, we have elected to study the leukocyte enzyme changes produced by nutritional manipulation. The leucocyte has the advantages of being a cell with a high turnover rate, is metabolically very active and is easily obtained. Furthermore, previous studies (Pineda, 1968) have shown that different enzyme activity changes occur in marasmus and kwashiorkor, indicating the susceptibility of the leucocyte enzyme machinery to different nutritional conditions. In these studies, polymorphonuclear leucocytes (PMN) were obtained from inflammatory exudates. Since then we have shown that PMN from blood and inflammatory exudates behave identically (Table 6).

In order to test the sensitivity of the PMN to varying protein and calorie intakes, we conducted an experiment with four pre-school age children who were fully recovered from protein-calorie malnutrition (PCM), according to clinical and biochemical criteria (Viteri and Alvarado, 1970). All the children were receiving a complete diet which provided 2 g of protein from casein supplemented with 0.2% methionine,

[1] GOT = Glutamic-Oxalacetic transaminase. GPT = Glutamic-Pyruvic transaminase. IDH and MDH = Isocitric and malic dehydrogenases, respectively.

TABLE 6. *Comparison of activities between blood and exudate polymorphonuclear leucocytes.*

Activity, nmoles/mg protein/min (30°C)

	FUM	MDH	IDH	GOT	GPT
Blood	23±3.1	42±7.3	10±2.4	24±5.1	13±2.5
Exudate	22±6.8	56±6.1	11±4.6	18±11.0	12±3.6

$\bar{x}$±S.E.

and 120 cal/kg body weight per day. Then, two children received 2 g of protein and 50 cal/kg per day and the other two children received 0.5 g of protein and 129 cal/kg per day. The diet was otherwise unchanged. Unfortunately one child in the low protein diet began vomiting and was discarded from the study. Close clinical supervision was maintained throughout the study, which lasted 6 days. Urine was collected continuously and partitioned in 24 hour samples for creatinine and urea determinations. On the day prior to the initiation of the administration of experimental diets, and again at days 3 and 6 of the experiment, 5 ml of venous blood was obtained and PMN were isolated and purified. The following enzymes were studied in PMN homogenates (Pineda, 1968): Fumarase, MDH, IDH, GOT and GPT.

Before going into a discussion of the results of this experiment, it is important to consider enzymatic adaptation as occurring in two consecutive stages: in stage 1,—acute adaptation—enzyme activity responds primarily to substrate concentration, and is mediated by a more efficient utilization of available substrates, while in stage 2,—chronic adaptation—enzyme regulation is most probably achieved by changes in enzyme levels (Weber, 1963).

Figs. 5 and 6 show the enzyme activities found in the blood PMN of these children and their urea excretion.

After 3 days of a high calorie, low protein diet, a stimulation of fumarase, MDH, IDH and GOT is already observed. No alteration in GPT activity is noted. Urinary urea excretion is diminished. In children maintained with high protein, low calorie diet, the acute stage is manifested by a marked decrease in all enzyme activities and a clear increase in urea excretion. At this acute stage of adaptation, there is a clearly defined difference in the activities of all the enzymes measured. At the end of 6 days on each diet the second stage of

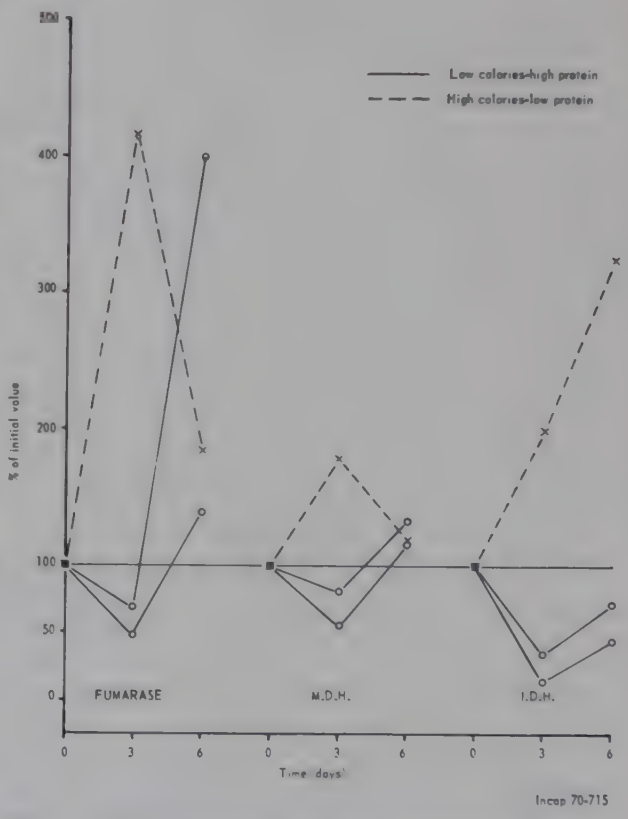

Fig. 5. Changes in polymorphonuclear leucocyte enzyme activities as a consequence of acute variations in protein and in calorie intakes.

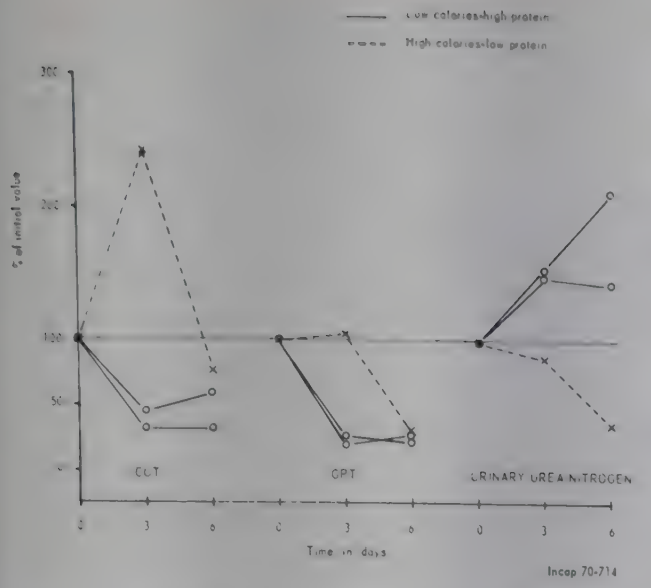

Fig. 6. Changes in polymorphonuclear leucocyte transaminase activities and in urinary urea nitrogen excretion as a consequence of acute variations in protein and in calorie intakes.

adaptation may begin to appear. The enzyme activities of PMN cells derived from protein deficient, high calorie children tend to descend. The only exception being that of IDH which continues to rise. The urinary excretion of urea is further depressed indicating a more efficient sparing of amino acids.

Calorie-deficient children, on the other hand, show a definite trend toward increased activity. Urea nitrogen also tends to become higher than in the acute stage.

A possible interpretation of the observed alterations induced by diet in the PMN-leukocyte is given in Fig. 7, where the arrows indicate trends in enzymatic activity.

Situation 1: high calorie, low protein diet.

Due to the relative excess of carbohydrate, there is an initial increase in the concentration of Acetyl-CoA which results in a greater synthesis of lipids and a higher rate of oxidation in the tricarboxylic acid cycle (TCA.) Under these conditions, α-oxoglutarate produced intramitochondrially will, through transamination, preferentially migrate to the cytosol. This implies that GOT stimulation occurs mostly in the intramitochondrial compartment. Since at this stage there is no stimulation of urea production there seems to be a definite sparing action on amino acids. In the case of GPT, the enzyme activity remains unaltered, probably indicating lack of need of oxalacetate production, especially in the cytosol. In the second stage, a new equilibrium of the TCA cycle is reached. Apparently, at this stage IDH promotes a more efficient economy of the cycle. Presum-

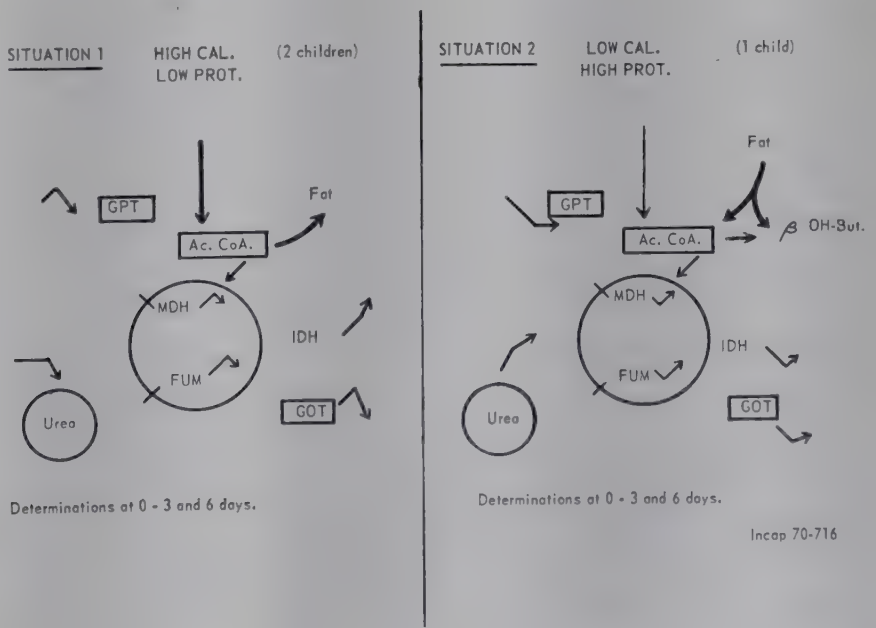

Fig. 7. Schematic representation of the metabolic responses induced by acute variations in protein and in calorie intakes (see text).

ably, the large concentration of Acetyl-CoA permits an overproduction of citrate which can be utilized extramitochondrially.

The decreased activity of GOT will contribute to maintain the energy cycle with a reduced turnover of amino acids. Since glucose production is of no concern in this situation, GPT also decreases. In this connection, it is worth mentioning that in livers of animals maintained for 5 days in a 90% glucose diet, the GOT and GPT activities are significantly decreased, both intra- and extra-mitochondrially (Pestaña, 1969).

Situation 2: low calorie, high protein feeding.

This is the type of diet that can on an *a priori* basis, be considered as leading to marasmus. After 3 days of this diet, the acute stage of adaptation is manifested by a general decrease both in TCA enzyme activities and in transaminases. Acetyl-CoA is mainly derived from fatty acid breakdown.

The stimulation of urea synthesis manifested by increased urea excretion apparently is unable to increase fumarase in the leukocyte. Consequently the activity of the TCA cycle remains depressed in the acute stage. Acetyl-CoA apparently is diverted for synthesis of acetoacetate and B-OH-butyrate instead of oxalacetate, since the TCA cycle activity appears to be depressed. In the second stage of adaptation, the cycle reaches a new, slightly higher equilibrium and the activities of fumarase and MDH are the ones that are more stimulated. This could be explained on the basis of increased availability of fumarase.

2. *Physiological repercussions*

As caloric restriction leads to the sacrifice of certain functions, it is important to try to assess when functional deterioration begins. Body weight loss, as was previously explained, and as has been shown clearly by Consolazio et al. (1968), leads also to hypohydration. It would be important, if possible, to ascertain the relative effects of caloric restriction on the one hand, and hypohydration, on the other, on functional deterioration. Studies of Buskirk et al. (1958), Saltin (1964, 1964 *a*), Greenleaf and Sargent (1965), and Greenleaf et al. (1966) have indicated that hypohydration produces a rapid deterioration of various functions related to the capacity to perform physical work (Fig. 8). This figure indicates the least body weight loss when initial deterioration for various functions occurs as a consequence of hypohydration, starvation and semi-starvation set points. Starvation (Henschel et al., 1954: Lategola, 1965; Consolazio et al., 1967), produces a similar pattern of set points as hypohydration. However, semi-starvation (Taylor et al., 1957) begins to alter hard physical work only when the body weight loss is greater than 10% in the absence of hypohydration (Brozek et al., 1957). In this connection, it would appear very important that for the preservation of physical capacity hypohydration be prevented as much as possible during famine.

Physiological deterioration is already present in chronically undernourished populations as is evident from the data presented in Fig. 9. In this figure some pertinent data on body composition and maximal oxygen consumption in three groups of young adult Guatemalan males is presented: the control group consisted of students of the military academy who were well nourished and physically fit; the other two groups consisted of agricultural peasants, one belonging to a very poor community, the other receiving a protein calorie supplement for 3 years prior to the study. Lean body mass was deter-

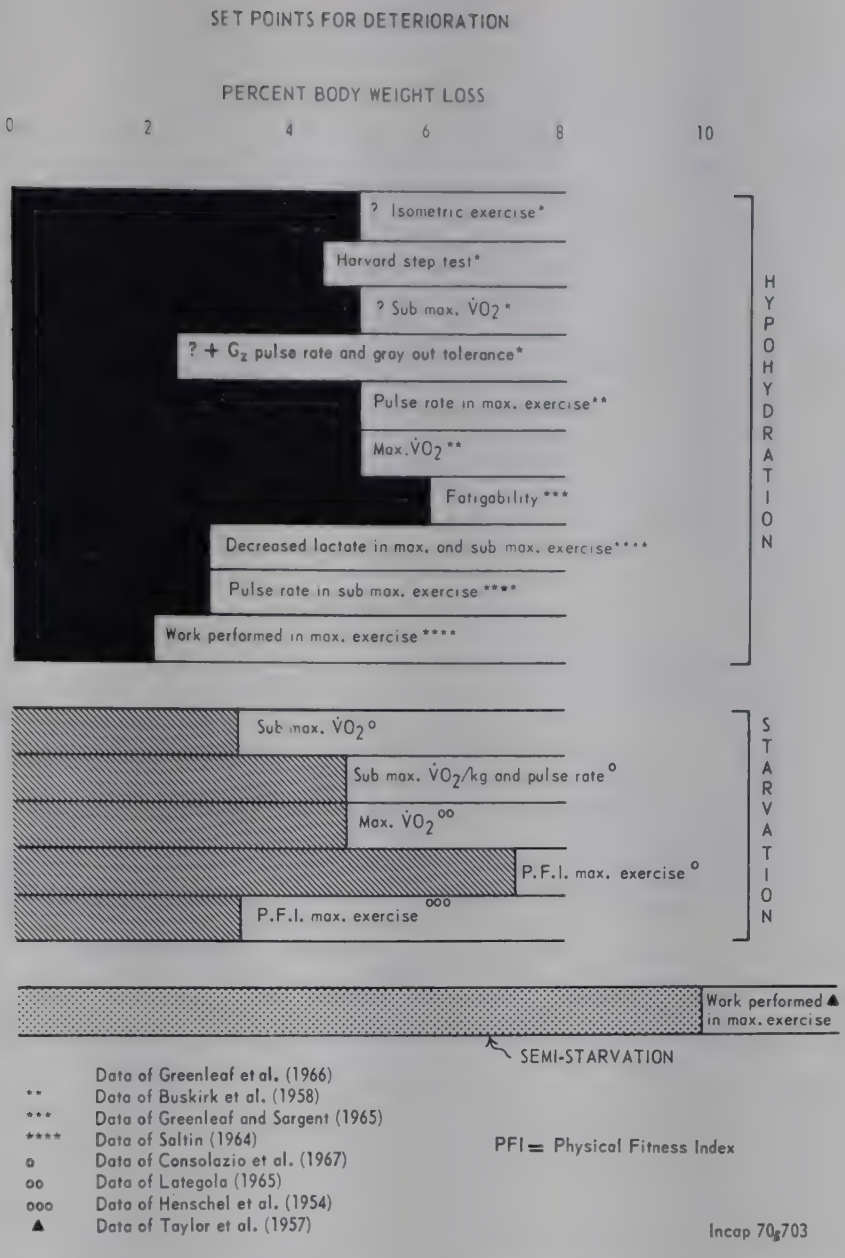
SET POINTS FOR DETERIORATION
PERCENT BODY WEIGHT LOSS
0
2
4
6
8
10
? Isometric exercise*
Harvard step test*
? Sub max. $\dot{V}O_2$ *
? + G_z pulse rate and gray out tolerance*
Pulse rate in max. exercise**
Max. $\dot{V}O_2$ **
Fatigability ***
Decreased lactate in max. and sub max. exercise****
Pulse rate in sub max. exercise ****
Work performed in max. exercise ****
HYPOHYDRATION
Sub max. $\dot{V}O_2$ °
Sub max. $\dot{V}O_2$/kg and pulse rate °
Max. $\dot{V}O_2$ °°
P.F.I. max. exercise °
P.F.I. max. exercise °°°
STARVATION
Work performed ▲ in max. exercise
SEMI-STARVATION
Data of Greenleaf et al. (1966)
** Data of Buskirk et al. (1958)
*** Data of Greenleaf and Sargent (1965)
**** Data of Saltin (1964)
° Data of Consolazio et al. (1967)
°° Data of Lategola (1965)
°°° Data of Henschel et al. (1954)
▲ Data of Taylor et al. (1957)
PFI = Physical Fitness Index
Incap 70-703

Fig. 8. Set points for functional deterioration in conditions of hypohydration, starvation, and semi-starvation.

mined by body density; the body volume was determined by underwater weighing by a modification of Goldman and Buskirk's procedure (Goldman and Buskirk, 1961). Muscle mass was calculated as stated previously. Maximal oxygen consumption was obtained by serial O_2 and CO_2 determinations by the Scholander technique (Scholander, 1947) during maximal exercise on a treadmill, following a schedule similar to that of Balke (1952). It is evident that the supplemented peasants approach the control group in body weight, body fat, lean body mass and maximal oxygen consumption, while the "poor peasant" group has very little fat, less lean body mass per centimeter height, and a lowered maximal oxygen consumption. Muscle mass in the control group is consistently higher than in the peasants, probably as a consequence of prolonged undernutrition during childhood and adolescense in the latter groups (Winick and Noble, 1965; Cheek, 1968).

On the other hand, excess blood lactate (Thomas et al., 1965) is higher in the control group than in both groups of peasants, even though the duration of maximal exercise is similar or even greater in the peasants (Fig. 10).

The decrease in maximal oxygen con-

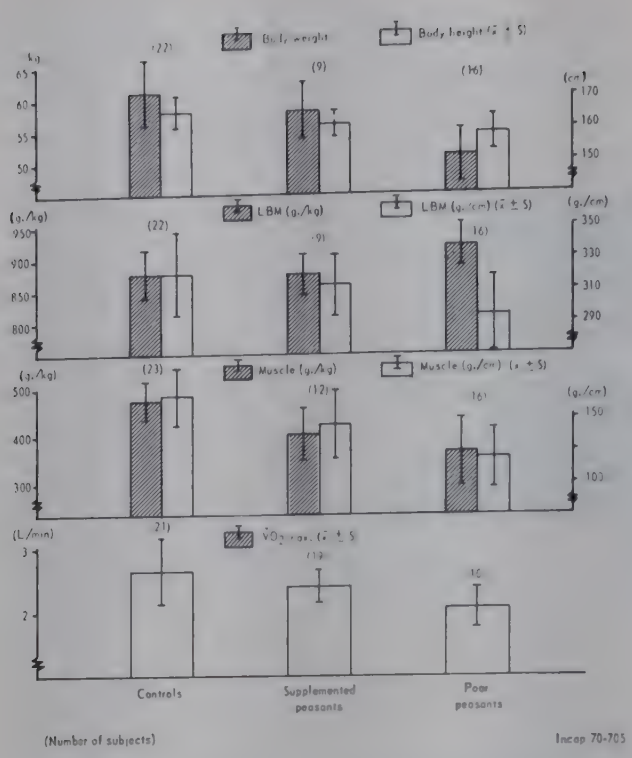

Fig. 9. Body composition characteristics and maximal oxygen consumption in three groups of young Guatemalan adult males with different nutriture (see text).

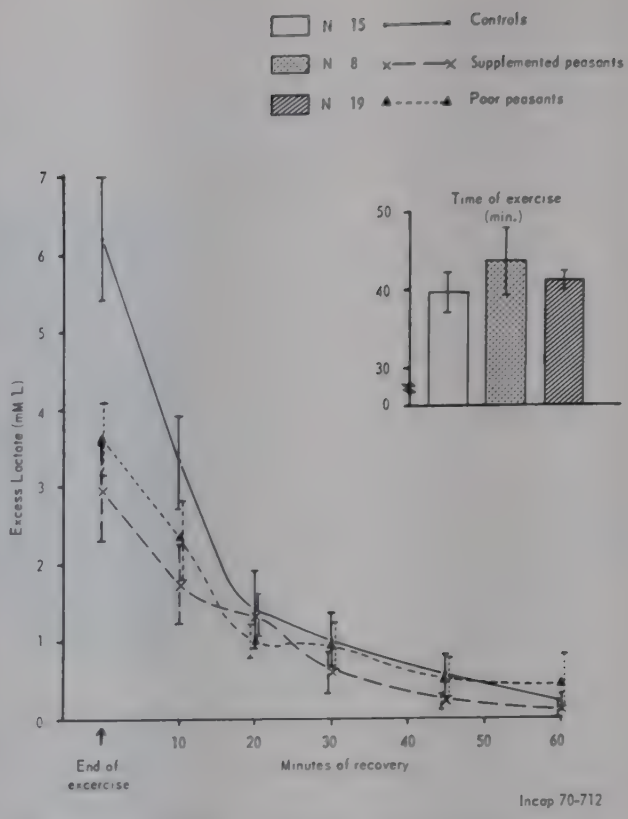

Fig. 10. Excess lactate production during maximal exercise in three groups of young Guatemalan adult males with different nutriture.

sumption in the "poor peasant" group is a consequence of their lower protein mass (Viteri, 1970 *a*). We cannot explain the lower excess blood lactate in both peasant groups as compared to the controls but it may indicate a lowered capacity for physical work as Saltin (1964) showed in hypohydration.

The hematological state of the individual also affects its physical capacity (Viteri and Torún, unpublished observations). In this regard we have studied, in PCM children upon admission to INCAP's Clinical Centre and during nutritional recovery, the relationship of the erythropoietic system to body protein and active tissue mass losses consequent to severe PCM (Viteri et al., 1968; Alvarado and Viteri, 1970). In the pig, Stekel and Smith (1969) have defined the anemia of prolonged calorie deprivation. In both nutritional situations the hematological changes observed appear to be primarily of an adaptative type. Fig. 11 shows the total circulating hemoglobin in relation to the active tissue mass, determined by serial basal oxygen consumption measurements. (Viteri and Alvarado, 1970 *a*.)

The body protein response to treatment is shown by the serial creatinine height index determinations (Viteri and Alvarado, 1970), and the bone marrow response to various treatments, by the reticulocyte index (Finch, 1966). It should be noted that when the child was severely malnourished, his total circulating hemoglobin was slightly above that expected for his active tissue mass, and that the administration of hematinics (Folic acid, Vitamin B 12, Iron and Vitamins E, C and the rest of the B complex) failed to produce a hematologic response while the child was maintained on a maintenance protein diet. Even more, the

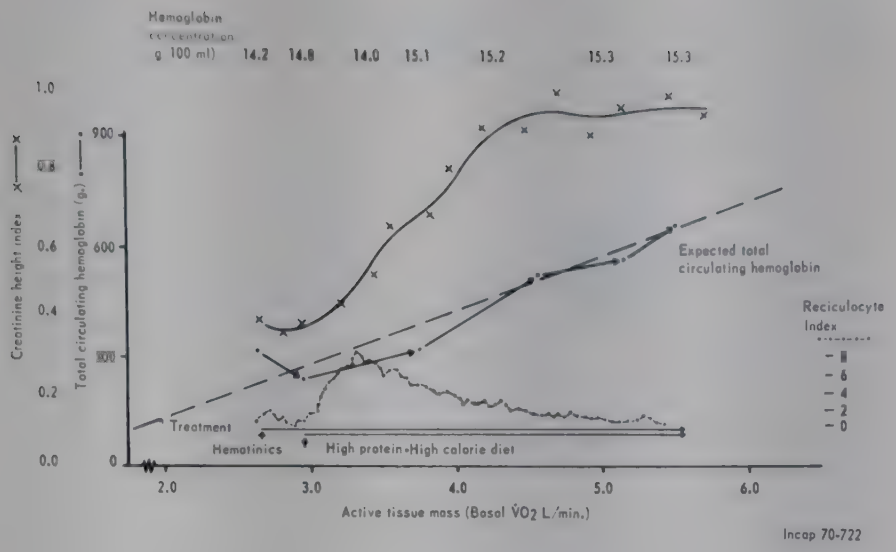

Fig. 11. Longitudinal hematological, body protein and active tissue mass changes in a protein-calorie malnourished child upon admission to the hospital and during nutritional recovery.

total circulating hemoglobin decreased. The hematological response was clear and prolonged when a high protein–high calorie diet was started. Initially, the increase in total circulating hemoglobin lagged slightly behind the expected values according to the changes attained, both in active tissue mass and total body protein mass, to catch up later in the course of treatment, with the expected values. The reticulocyte response persisted elevated while the creatinine height index was increasing up to a stable value around 0.95.

From the previous considerations it appears obvious that famine, superimposed on chronically undernourished populations, should have a more deleterious effect both in the capacity to perform physical work and on survival.

3. *Effect of environment*

It has been clearly shown that an unhealthy environment imposes a nutritional stress in individuals, primarily through infection (Scrimshaw et al., 1968; Mata, 1969). Metabolic studies in children and adults suffering from various types of infections (Wilson et al., 1961; Viteri, 1970 *b*; Beisel et al., 1967) have revealed that infection produces various degrees of nutritional deterioration. Diarrhoea, whether of infectious origin or not, also produces caloric and protein losses through the stool (Pinter and McLean, 1968) and often an increase in urinary nitrogen. In Fig. 12, the effect of diarrhoea and of measles on the nitrogen balance of children is depicted. The decrease in nitrogen retention due to either process is obvious. It is interesting to note that the maximal effect of measles on nitrogen loss occurs during the incubation period. Due to the long duration of this period, a large nitrogen loss occurs.

McCance and Mount (1960) also showed that undernourished pigs had low body temperature, and Widdowson (1968) stressed the deleterious effect of a cold environment on such animals.

In consequence, the effects of famine can be aggravated by unfavourable environmental conditions.

4. *Psychological effects*

Famine provokes a series of psychological reactions, both at the individual and at the social organization level (Keys et al., 1950). Many of the reactions are influenced markedly by the situation in which famine

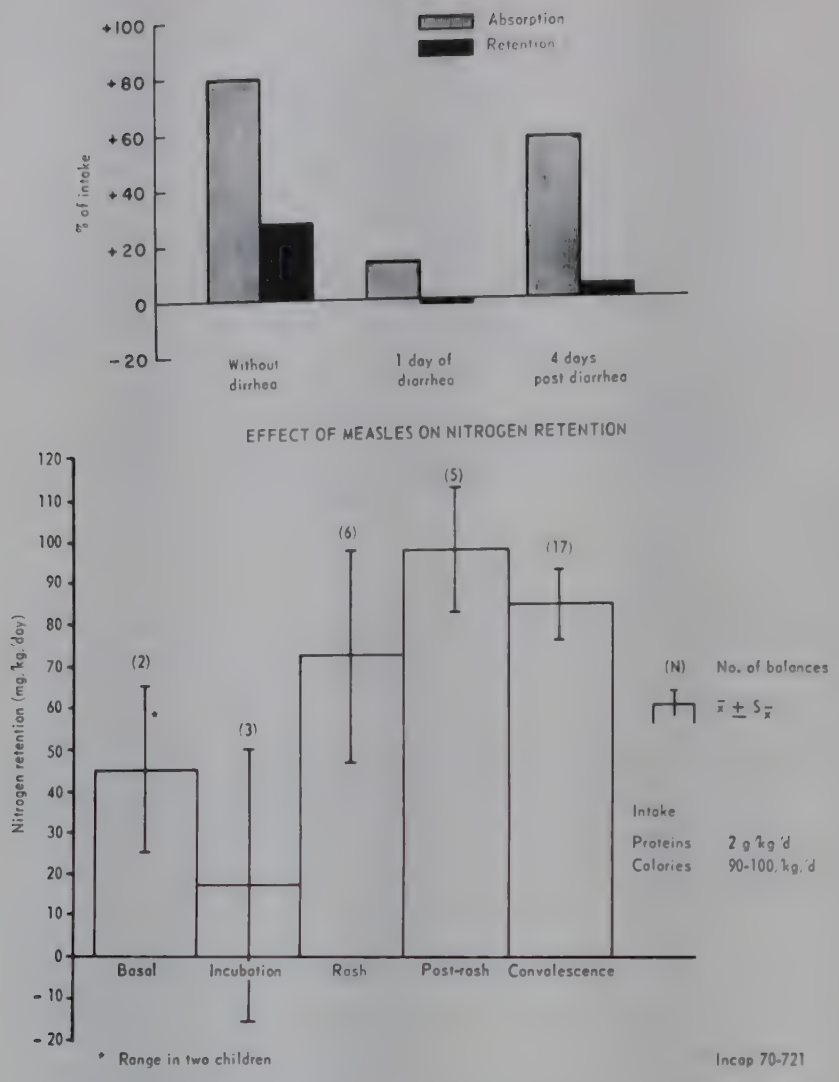

Fig. 12. Effect of diarrhoea, and measles on nitrogen absorption and retention.

occurs. The presence of an agglutinating force within the famine area, be it small or large, reduces the undesirable psychological effects. The agglutinating force can be a strong leader or a common ideal which inspire the people to maintain psychological integrity. The trend in famine victims, however, is to suffer disintegration of their psychological make-up. Often subjects are prone to apathy, irritability, depression crisis which can end in suicide, introversion and, on occasion, extreme aggressiveness. In severe famines increased number of assassinations and cannibalism have been reported (Fisher, 1927).

The sensation of hunger, which is notoriously absent during short periods of starvation, begins to impose an added burden on the individual as fasting progresses. Often, population groups survive on concoctions which no one would ever consider eating under normal conditions. Dreams of food and nightmares disrupt sleep and are common in prolonged semi-starvation and famine.

Finally, a trend toward a very critical introspection and hysteria are not uncommon. Spiritualism is often increased.

5. *Rehabilitation programmes*

Rehabilitation programmes should be carried out bearing in mind that calorie and protein restriction lead to maximal adaptation. Protein deficient animals subjected to starvation show 100% mortality when re-

TABLE 7. *Effect of refeeding a complete diet after 8 days starvation or semi-starvation in rats.*

% casein in diet	Treatment	Refeeding	% survival
5	Starved	20 % casein	0
5	Semi-starved	20 % casein	100
5	Starved	2 days glucose, then 20 % casein	83
20	Starved	20 % casein	33
20	Semi-starved	20 % casein	100
20	Starved	2 days glucose, then 20 % casein	100

fed a normal diet (Table 7). In well nourished animals subjected to the same procedures the mortality was also elevated. In contrast, the administration of glucose for 2 days prior to refeeding a complete diet, drastically decreased the mortality in starved animals, whether previously well nourished or not. Our own experience in treating severely malnourished children also indicates that an initial cautious rehabilitation programme should be undertaken. In order to prime the readaptation of the multiple enzyme systems to normal food loads after severe famine, we suggest the institution of a diet containing moderate amounts of protein and easily available energy sources followed, in 2 or 3 days, by a progressive and varied diet.

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THE CAUSES, EFFECTS AND REVERSIBILITY OF PROTEIN-CALORIE MALNUTRITION

by R. G. Whitehead[1]

It is important that organisations who have the responsibility for helping countries in times of national disasters should understand the various factors involved in the development of malnutrition.

It is often a surprise to relief teams, especially those quickly on the scene, to find quite extensive malnutrition in a country and they must wonder how such a serious situation could have developed in a short time. This is often because the general health and nutrition of the children will have been far from ideal even before the disaster. This is particularly the case when a disaster hits a country where chronic malnutrition is already endemic.

Various research units in different parts of the world are now concentrating on a study of chronic subclinical malnutrition and the development of the child into a state in which he is unusually sensitive to a further deterioration in his environmental circumstances. Such a child is often described as being at "nutritional risk". It is clearly of importance to be able to detect children in this state for it is they who should have priority in nutritional relief measures.

Before discussing the various reasons why a child might become at "nutritional risk" we must first look at two children suffering from quite definite *severe* malnutrition.

The child in Fig. 1 is a case of severe kwashiorkor. The main features are marked oedema, skin lesions, severe mental apathy and anorexia. The child is very underweight for his age.

Fig. 2 shows a case of nutritional marasmus. The child looks quite different—there is no oedema but he is clearly severely underweight for his age.

These cases represent the two extreme ends of the spectrum which is loosely called protein-calorie malnutrition.

Causes of Protein-calorie Malnutrition

It is generally assumed that kwashiorkor is caused by a diet which contains too little protein for maintenance and growth but more or less adequate amounts of calories. The cause of marasmus is generally agreed to be a lack of food—starvation (McCance, 1968).

There is reason to believe, however, that this is by no means the whole story. At the MRC Child Nutrition Unit in Kampala we have been studying various other environmental factors which may contribute to the development of malnutrition in Ugandan children. We are also investigating the progressive anthropometric, clinical, physiological and biochemical changes which accompany the development of malnutrition with the ultimate aim of providing a system for the detection of the child at nutritional risk.

Malnutrition almost always results in an

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Fig. 1. Severe kwashiorkor.

underweight child and most children in Uganda exhibit a marked faltering of growth during the first 3 years of their life (Fig. 3). It was essential to know the reason for these persistant episodes of weight faltering. Were they due principally to the quality of the diet? This has usually been assumed in statistical reports from surveys carried out in developing countries. Or were other factors involved as well?

Our research project in run by a team consisting of paediatricians, nutritionists and biochemists and thus detailed sequential investigations, covering a wide field of measurements, are possible. We have found that the quality of the diet is by no means the only causative factor involved in weight faltering (Fig. 4). Very often the faltering of growth is the *primary* result of some infection and the child in Fig. 4 is a good example of this. This is not a pecularity of developing countries, it is a common finding in Europe but there children tend to be ill rather less often and therefore do not show this accumulative effect. The diet in Europe can also support a rapid rate of

Fig. 2. Nutritional marasmus.

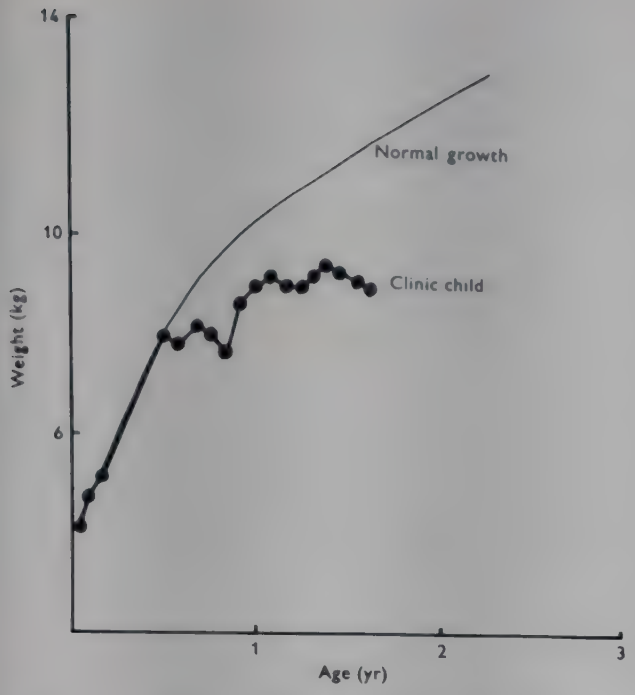

Fig. 3. A typical faltering growth curve of a child attending an outpatient clinic in Uganda.

catch-up growth once the illness is over but this is not always the case in developing countries. Virtually any type of infection can produce this response; the main reason is probably the anorexia associated with the illness, although food taboos about not feeding during an illness may also play a role.

Because of these and similar findings from a large study carried out in Guatamala (Mata, Urrutica and Garcia, 1967) we should regard protein-calorie malnutrition as an environmental disease. The cause of protein-calorie malnutrition is not just a lack of availability of dietary protein and calories. Secondary malnutrition, caused by anorexia resulting from infection or parasite infestation is at least as important.

It is because protein-calorie malnutrition is an environmental disease that its features differ so from country to country. The inconsistency of the pathology and pathophysiology of the disease has been a problem to nutritionists for many years. For the layman or administrator responsible for the implementation of relief schemes this lack of a precise description as to the exact causes and effects of protein-calorie malnutrition must have been exasperating as no two nutritional investigators seem to agree with each other. If protein-calorie malnutrition were just caused by primary dietary deficiency then a more consistant pathological pattern would result, as it does in planned nutritional experiments in animals. Once the concept of an environmental disease is accepted, however, the reasons for the complexities encountered in protein-calorie malnutrition can be more easily appreciated.

Table 1 shows just a few of the environmental factors which might affect the course of development of protein-calorie malnutrition in a particular country.

These environmental variables are important; they dominate many of the topics discussed in this chapter; they affect the exact way in which a child can modify his metabolism in an attempt to maintain homeostasis during nutritional stress; they determine the way body structure and func-

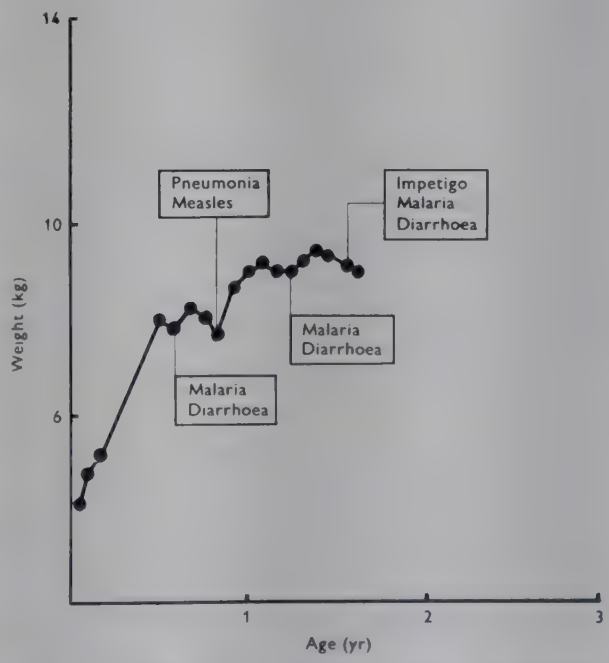

Fig. 4. Diseases associated with the faltering growth curve in Fig. 1.

TABLE 1. *Factors which may affect the development of protein-calorie malnutrition.*

Relative amounts of protein and "calories" in the diet
Chemical composition of the proteins
Chemical composition of the "calories"
Superimposed deficiencies of different vitamins
Superimposed deficiencies of different minerals
Nature of the pattern of infections
Nature of the pattern of parasite infestations
The age of the child
Possible genetic variation in susceptibility to malnutrition
Length of "chronic" episode of malnutrition
Social and psychological factors

tion is changed during a period of subclinical malnutrition. These latter two considerations are important because biochemical tests and anthropometric measurements are important tools for nutrition surveys. Clearly, the results of such tests must be interpreted in the light of all environmental factors, not just dietary intake.

Information on the whole environment is necessary if preventative nutrition relief work is to be effective. Clearly there is little point in supplying just food if worm infestation or infections leading to diarrhoea and vomiting or anorexia are endemic in an area. Food is of little nutritional value if it cannot be utilised. Relief operations would be made easier if more detailed *environmental* information were available from different parts of the world. Aid could then be based on *specific needs* and not just on elementary generalizations.

Effect of Malnutrition

(*a*) *Development of nutritional marasmus*

The exact nature of the pathological abnormalities which develop due to malnutrition depend on the presence or absence of numerous environmental causative factors.

If there is a general shortage of food the body wastes away until nutritional marasmus develops. The wasting of the body under these conditions can be regarded as a normal physiological process. The body tissues need energy for survival and if it is not available from the food it must come from the body itself.

In mild calorie deprivation, the body gradually takes on a lean look. In the child, measurements such as mid-upper arm curcumference, thigh circumference and chest circumference do not increase with age as they should and the skin fold thickness, which is basically a measure of subcutaneous fat, tends to fall. The general apperance may be a rather slim, but superficially normal child. Because growth in height is also retarded, one is often surprised at the real age, a child often looks younger than he really is.

In more severe calorie deprivation the body starts to waste away more extensively and growth in height ceases completely. At this point, there can then be little doubt that the child is malnourished.

During an acute episode of starvation one of the main problems for the body is the supply of energy metabolites. This is summarized in Table 2. The brain uses mainly glucose as an energy source and

TABLE 2. *Adaptation to starvation.*

Response	Effect
Growth stops	Nutrients preserved for maintenance
Fat stores depleted	Energy available for tissue metabolism
Liver and muscle glycogen utilised	Initial maintenance of blood glucose needed for brain metabolism
Muscle wasting	Glucose synthesis from protein

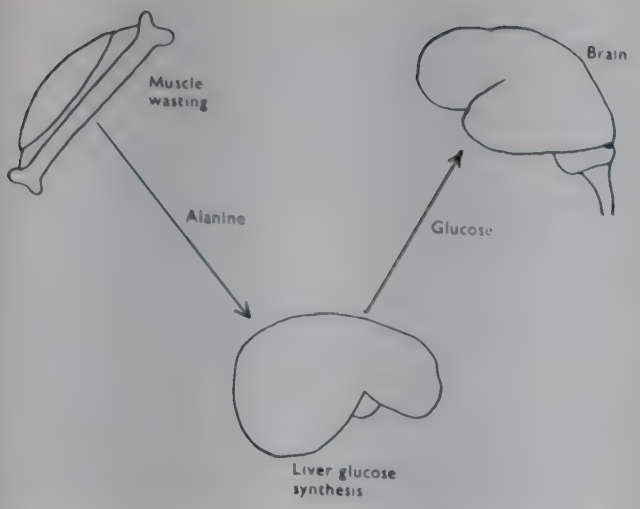

Fig. 5. A summary of gluconeogenesis during the initial phase of adaptation to starvation.

initially it is not able to oxidize or burn fat for energy as do the other organs of the body. There is a temporary store of carbohydrate in the form of glycogen in the liver and muscles and hormonal stimulation results in the release of extra glucose from these tissues into the blood but this supply of energy metabolites is quickly exhausted. Glucose then needs to be made, in increasing quantities, by the metabolic process, gluconeogenisis. Basically protein is broken down to its amino acid constituents, the nitrogen in the amino acids is then removed and discarded in the form of urea and the remaining carbon moiety is utilized for glucose synthesis. Muscle is the major source of protein for this process and this is why muscle wasting is such a major feature of marasmus.

Felig, Owen, Wahren and Cahill (1969) have studied in detail the importance of gluconeogenesis in starvation and have shown that the amino acid, alanine, plays a very important role (Fig. 5). It is suggested that after the amino acids have been released into the muscle metabolic pool transamination reactions result in the formation of increased amounts of alanine which is carried to the liver where uptake of this amino acid takes place. Further transamination results in the formation of pyruvate from which glucose can quickly be synthesized. The uptake of alanine by the liver during active gluconeogenesis is so greatly increased that a marked lowering in the concentration of serum alanine results, in spite of the increased rate of synthesis in the muscles.

Simple calculations reveal, however, that if this process continued for very long the muscles would soon waste away completely but we know that man and even children can survive surprisingly long periods of starvation and still retain some of their skeletal muscle. The reason is that after about 7–10 days starvation the metabolism of the brain becomes sufficiently adapted to the oxidation of fat metabolites, that energy requirements can be satisfied almost completely from this source, and the requirement for glucose is reduced (Owen, Morgan, Kemp, Sullivan, Herrera and Cahill, 1967). Muscle wasting is decelerated and probably because of this serum alanine levels remain low. Gluconeogenesis continues but at a relatively slow rate, due to a lack of the necessary basic substrate, alanine.

The human body is metabolically well adapted to deal with temporary starvation. During the course of evolution man has had to become adapted to this situation for in the wild state, man the hunter would often have to exist for short periods without food. In the individual suffering from calorie deprivation measurements of homeostasis such as serum albumin concentration or the aminogram are often quite normal; the main feature is body wasting. It is for this reason that anthropometric measurements are so useful in assessing nutritional status under these conditions and why biochemical tests are of little value.

(b) Development of kwashiorkor

The metabolic changes taking place during the development of kwashiorkor are quite different from those I have described for nutritional marasmus. I have said that man is well adapted to survive periods of starvation but he is much less able to cope with stresses associated with the ingestion of low protein-high carbohydrate containing diets. Biochemical changes, indicating a difficulty in the maintenance of homeostasis, are a major feature during the development of this type of protein-calorie malnutrition. In simple starvation, the breakdown of tissues not only satisfies energy requirements but it also supplies essential metabolites for the synthesis of important homeostatic components. For example the concentrations of free amino acids in the serum are essentially normal and serum albumin concentration is maintained. In children living on low protein-high carbohydrate diets, however, there is less need for an accelerated tissue catabolism since sufficient energy is available from the diet. For this reason the amino acid pools become depleted in essential amino acids and the synthesis of proteins such as albumin becomes reduced.

As with calorie deficiency, however, the earliest change which can be detected along the road to kwashiorkor is a faltering of growth although a complete cessation only occurs in the most severely affected children. Metabolic processes associated with growth such as the synthesis of the connective tissues of bone and skin gradually become curtailed and there is often a reduction in the excretion of hydroxyproline containing peptides in the urine (Whitehead and Coward, 1969). Hydroxyproline is an amino acid confined to collagen and connective tissues. The low intake of protein in relation to the requirements results in a reduction in the excretion of urea and if one measures the ratio of urea/creatinine in the urine, values only a fraction of normal are found (Arroyave, 1969). These metabolic changes probably reflect an attempt by the body to conserve protein. Waterlow (1968) has recently reviewed the modifications in cellular enzyme patterns which take place to achieve this end. Enzymes associated with protein synthesis such as the amino acid activating enzymes tend to increase in activity whilst those connected with urea production loose activity.

This conservation of protein occurs both in kwashiorkor and marasmus but other biochemical changes are characteristic only of the kwashiorkor pathway. Certain serum amino acids, in particular valine, tend to rather low concentrations (Grimble and Whitehead, 1970). In a normal child, valine is usually in the range of 200–300 μM/l, but in a child living on a rather low protein, relatively high carbohydrate containing diet, values of 90–150 μM/l are more common. Again this probably means that protein supplies are inadequate in terms of the demands imposed by maintenance and growth but also indicates that little tissue breakdown is occurring to correct these serum levels which would be the normal homeostatic response under conditions of starvation. The effect of dietary carbohydrate, under the mediation of insulin, probably inhibits this process (Grimble and Whitehead, 1971).

Hair changes are a well known feature of kwashiorkor in Uganda and can provide an early sign that all is not well in the nutritional health of the child. Changes begin to occur around the temples and the hair becomes sparse and less pigmented (Fig. 6). This picture can spread to other parts of the head (Fig. 7). The textbook picture of the child with a complete head of blond

Fig. 6. Sparseness of hair around the temples of a child with a faltering growth curve.

hair is also seen but it is found in by no means all subclinically malnourished children. Morphological details associated with hair changes in kwashiorkor have been reviewed by Bradfield (1968) and Sims (1969).

Without further investigations it is impossible to say what the metabolic significance of these hair changes is. They begin to occur early and could represent a further attempt by the body to reduce nitrogen loss on a tissue of little functional importance. It is perhaps a mistake to assume a teleological explanation for this abnormality. Man is the hairless ape, one of his weaknesses is to loose hair, perhaps this weakness is easily exploited by adverse circumstances.

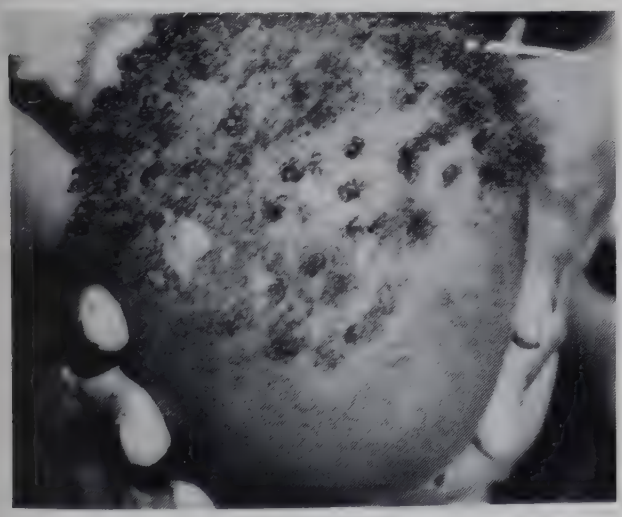

Fig. 7. Extensive hair loss in a subclinically malnourished child.

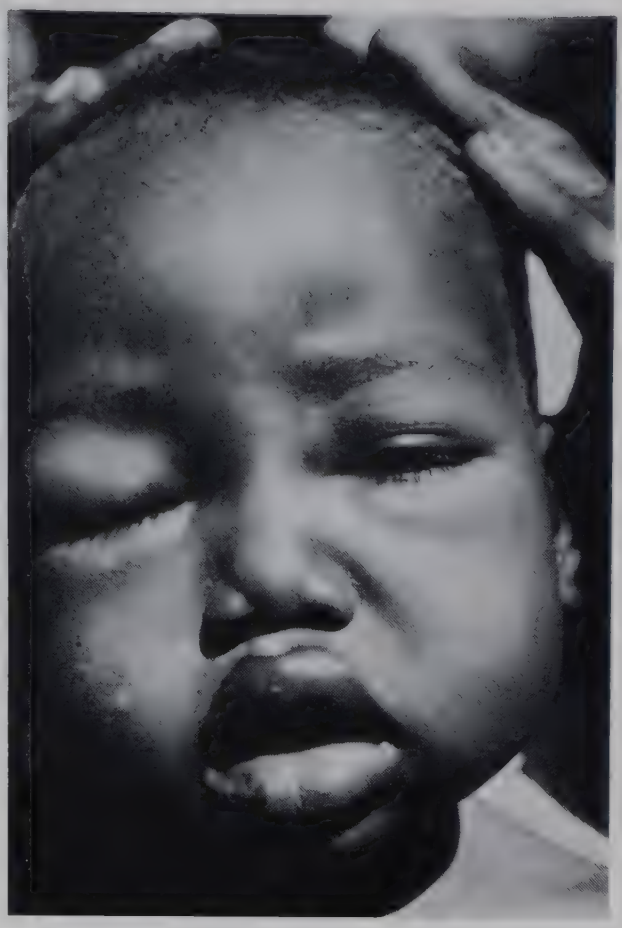

Fig. 8. Facial oedema in a malnourished child.

Another feature of the child developing into kwashiorkor is the moon face. In early cases this can be a rather subjective sign; but in more severely affected children there can be little mistake in recognizing the abnormality (Fig. 8). The moon face is probably associated with two metabolic abnormalities, the tendency to accumulate subcutaneous fat and the accumulation of extra cellular water or oedema. It is likely that the moon face is more associated with oedema than fat for except in the "sugar baby" excessive accumulation of subcutaneous fat is rare. A moon face can often be seen before pitting oedema is clearly definable in the legs (Fig. 9).

The metabolic causes of oedema are

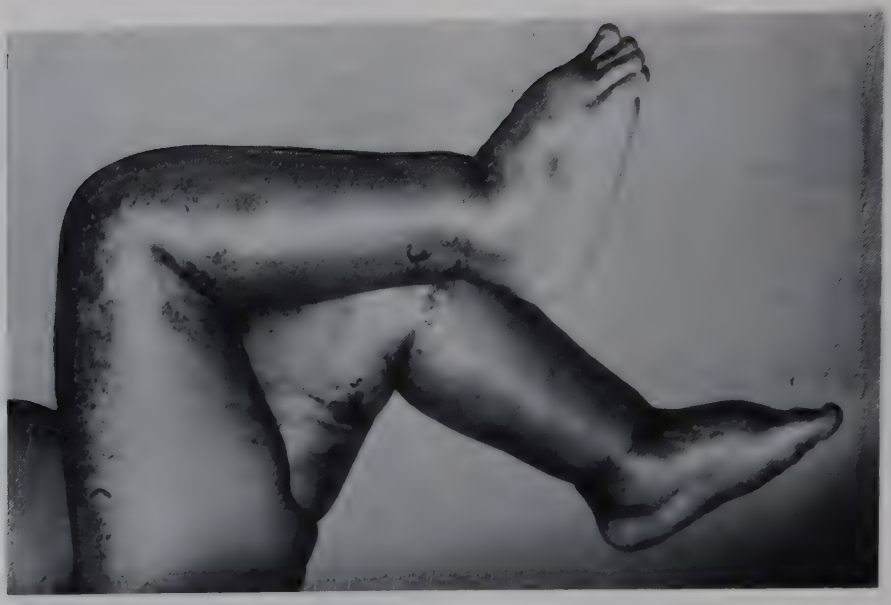

Fig. 9. Pitting oedema of the legs in a child with kwashiorkor.

complex and are by no means completely understood. Oedema in kwashiorkor is almost invariably associated with a low concentration of serum albumin, although low serum albumin levels are probably not the sole cause of the oedema, hormonal activity associated with the retention of sodium may also play a role. Mothers of children progressing towards kwashiorkor often complain to our paediatricians about "intermittent swelling". In a recent study in Uganda we have shown that these complaints are confined to children with albumin levels of less than 3.0 g% and that slight oedema, typified by a moon face and/or marginal puffiness of the feet is found in most children after albumin levels have fallen below 2.5 g%. Thus a failure in the maintenance of homeostasis as indicated by a serum albumin level of less than 2.5 g% must be regarded as a definite warning sign of susceptibility to oedema.

The reason for this fall in serum albumin concentration in children following the kwashiorkor road to malnutrition is the subject of much research. It would seem that the ability to synthesize albumin and other proteins is maintained even in quite severe malnutrition (Picou and Taylor-Roberts, 1969) but that less albumin is synthesized probably due to a lack of substrate at the site of synthesis. It is possible that the relative excess of carbohydrate in the foods eaten by these children may affect albumin synthesis by stimulating the passage of amino acids to muscle rather than liver. Under more ideal circumstances this process is termed the protein sparing action of carbohydrates and is beneficial (Munro, 1964) but in primary protein malnutrition this mechanism may do more harm than good. Certainly the main biochemical feature of kwashiorkor is a low circulating albumin concentration.

Another early feature of impending malnutrition is a tendency to accumulate fat in the liver. Scientists argue about the cause of this fatty liver but there is speculation that it may be due to the lack of the lipoprotein carrier necessary for the transport of fat from the liver once it has been synthesized (Truswell, Hansen, Watson and Wannenburg, 1969). Probably the source of metabolites for fat synthesis is dietary carbohydrate but under episodes of acute starvation or diahorrea and vomiting mobilisa-

TABLE 3. *Examples of failure to maintain homeostasis in children developing kwashiorkor.*

Distorted serum aminogram
Low serum albumin
Fat accumulation in the liver
Extra-cellular oedema

tion of subcutaneous fat may aggravate the situation because of the liver's inability to handle this fresh source of metabolite.

In contrast to marasmus the road to kwashiorkor is typified by metabolic derangements and difficulties in the maintenance of homeostasis. Some of these abnormalities are summarized in Table 3. It is not surprising that many scientists look towards biochemistry for ways of assessing nutritional status in this type of subclinical malnutrition. It is unlikely, however, that any single test will provide the necessary answer and many of us are working on metabolic profiling systems.

(*c*) *Marasmic kwashiorkor*

Since weight faltering and kwashiorkor develop because of a complex inter-action between primary protein deficiency and secondary malnutrition due to anorexia during infections, it is not surprising that most malnourished children with oedema show signs of both kwashiorkor and marasmus. This situation is usually described as marasmic kwashiorkor.

REVERSABILITY OF PROTEIN CALORIE MALNUTRITION

Basically the patho-physiological effects of malnutrition can be reversed by food, but many children, in Uganda the majority, require other therapies to cure intercurrent infections and infestations.

Some children do not respond to dietary therapy. Deaths from severe protein calorie malnutrition in hospitals from different parts of the world have recently been reviewed by Wharton (1970) and average about 20% of the cases admitted. The reasons for this lack of reversability are various but often the root of the trouble is infection, especially if this is associated with severe anaemia. Some children seem to die a metabolic death because the chemical pathological consequences of kwashiorkor cannot be reversed. Notable in this category is hypoglycaemia and hypothermia (Wharton, 1966). In other children, severe tissue damage may prevent recovery. In Uganda, cardiac failure is a common cause of death partly due to a grossly abnormal myocardium (Wharton, Howells and McCance, 1967). In Jamaica signs of terminal liver damage are more often encountered (Garrow and Pike, 1967).

For the 80% of children who are able to recover a main consideration must be the provision of adequate amounts of protein, calories and other essential nutrients to quickly correct the body's homeostatic balance and to allow a rapid rate of catch-up growth. Children can grow at a rate of 70 g/day for many weeks if dietary and other therapies are adequately maintained. Theoretical reasoning and practical experience have shown that about 2.5 g milk protein/kg body weight/day is necessary to support this rate of growth but it is perhaps wise to give rather more, and we recommend 4.0 g/kg to cover administration mishaps and losses due to vomiting etc. If the child is severely anorexic the nutrients must be got into the body somehow and one of the best ways is intra-gastric drip and, therefore, milk therapy is to be preferred. It is no use, however, feeding just dried skimmed milk alone. This food does not con-

tain sufficient calories to support this enhanced metabolic rate. Extra calories can be added in the form of oil and sugar (Staff, 1968) and extra high carbohydrate-containing staple should be provided if the appetite of the child allows. A malnourished child needs 140–200 kcal/kg if his progress is to be satisfactory. This contrasts with the 100–120 kcal/kg normally recommended for a child during the first year of life. In certain areas vitamin supplements may also be necessary and various mineral supplements may be called for according to the specific needs of the child.

The ability of the majority of children to respond to treatment is amazing. Biochemical abnormalities such as serum albumin levels can be restored to normal within a week or two, oedematous limbs, the fatty liver and skin lesions are repaired almost as quickly (Trowell, Davies and Dean, 1953). It may take several months, however, before musculature is fully restored in terms of the child's height (Reindorp and Whitehead, 1971).

It is still not known for certain if there are many long term sequali to malnutrition. This is being studied in many parts of the world but it can be said that, superficially at least, even the most severely malnourished child can grow up to live a productive life. Whether or not he really achieves his full potential is still a matter of conjecture (Kreuger, 1969). Whether there is permanent damage to various organs of the body, including the brain, also needs further investigation.

Groups Vulnerable to Protein-calorie Malnutrition

Starvation and protein calorie malnutrition can affect man at any age as is all too well known, but clearly sections of the community having the highest need for nutrients will be most at risk. This is why in many countries malnutrition is so common in the pre-school child group. The age of cessation of weaning is so important in this context.

The displaced child, displaced from the breast at too early a stage because of a new pregnancy, is an important social factor in the development of protein-calorie malnutrition in Uganda as well as in many other countries.

Nutrient needs are also increased during pregnancy and lactation, particularly the latter. 850 ml breast milk contains 10 g protein and this must be supplied by the diet or the quantity of milk or the health of the mother will suffer. My colleague, Dr J. P. Stanfield, has seen young lactating mothers in Rwanda queueing at a dispensary showing quite definite signs of kwashiorkor.

Conclusion

Attacking malnutrition during times of national disaster depends on a clear understanding of the environmental factors underlying the malnutrition in that country, a knowledge of the pathological consequences of this malnutrition and the pre-training of efficient teams to put this knowledge to use.

Summary

The pathological picture found in protein-calorie malnutrition is not just caused by a primary dietary deficiency of protein and/or calories. Other factors, which vary from environment to environment, affect the course of the disease.

Nutritional marasmus, caused by starvation, is typified by gross body wasting caused by the body's need for energy meta-

bolites. In kwashiorkor body wasting is less marked but the child exhibits a variety of biochemical abnormalities indicating difficulties in the maintenance of homeostasis.

The effects of protein-calorie malnutrition can be reversed rapidly in the majority of children providing adequate amounts of protein (3–4 g/kg/day) and calories (140–200 kcal/kg/day) are efficiently administered.

Protein-calorie malnutrition affects predominantly children in the age group 0–4 although other age groups may become malnourished, in particular pregnant and lactating women.

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Summary of Discussion

Rapporteur: Leif Hambræus

Malmros asked if other types of carbohydrates such as lactose, fructose, sucrose, and starch would have the same effect as glucose in the development and treatment of malnutrition. *Whitehead* answered that it is essential to consider the type of sugar to be fed during recovery because of the problem of diarrhoea. Lactose intolerance can be a problem and seriously affect the use of milk preparations in the treatment of malnutrition. This might be aggravated further if a child inherits a low lactase activity or if he has become disadapted to digesting lactose because of a lack of milk in the customary diet. This underlines that the development of malnutrition is not only a matter of dietary deficiency but of many environmental factors which vary from country to country. Therefore there can be no fixed

method of treatment of malnutrition and every child has to be treated as an individual. With respect to the development of malnutrition he believed that the ingestion of sucrose rather than starch might be an important factor in the development of fatty liver. It has been postulated that if you feed starch, fatty liver occurs to a much smaller extent in an animal than if you feed sucrose. This is probably because glycerol is easily synthesized from fructose. During recovery it is essential to consider the type of sugar to be fed.

Friis-Hansen wanted to stress that the formation of extracellular fluid as oedema required retention of sodium chloride as well as water. Thus the intake of sodium is as important as the aldosterone and ADH regulating systems. A high intake of sodium can result in retention of sodium and formation of oedema. If a soup which is given to starving people contains a lot of salt, in order to improve the taste, oedema can result.

Ramalingaswami asked why a marasmic child is said to be well adapted to starvation and a child with kwashiorkor not so well adapted. In attempts at rehabilitation, the situation is often the reverse, the child with kwashiorkor responding much better. Is the term adaptation synonymous with an alteration in the concentration of substances which then remain fairly normal, whereas in the other case they don't? Is this sufficient justification for using the term adaptation? *Ramalingaswami* also referred to changes that occur in the ultrastructure of the liver within hours of placing an animal either on a low protein diet or a low calorie diet. The changes are quite different in the two cases; there is glycogen accumulation and attenuation of the endoplasmic reticulum and disappearance of ribosomes in the kwashiorkor type, whereas in the marasmic type within 12 hours the glycogen disappears and there is a shrinkage of the cells. The changes take place quite early in both situations and often in reverse directions but can easily be corrected in early stages.

Whitehead agreed that it is a matter of philosophy whether we have met an adaptation or not, when the child modifies his metabolism so that he can survive under the grossly adverse circumstances in which he has been forced to live. During the course of starvation the body can break itself down to provide energy and this also provides essential nutrients which can then be used for the synthesis of essential biochemical components. He referred to experience of the serum albumin level which is quite normal in marasmus but low in kwashiorkor. In kwashiorkor the child gets insufficient amounts of essential amino acids in the diet and the gap cannot be filled by the breakdown of tissues because the carbohydrate intake stimulates the formation of insulin, which tends to make the amino acids move into the muscle rather than in the reverse direction. In other words, the body's ability to maintain homeostasis is upset.

Viteri commented on the question of whether we do better with kwashiorkor than with marasmus in the early stages of rehabilitation. The child with kwashiorkor has a high carbohydrate intake which, as has been shown in animals, will produce a high insulin output. Insulin is a hormone which produces fat and protein accumulation in muscle, and as such is a "luxury hormone" which is acting in the child who is already protein depleted. The result is one of diversion of the amino acid supply from the viscera. However, this high carbohydrate intake may be useful in maintaining certain enzyme mechanisms which are still functioning and which may facilitate initiation of anabolic functions when a therapeutic diet is started. With regard to recovery, it takes the same time to achieve recovery of a kwashiorkor state as of a state of marasmus. In kwashiorkor it takes time to recover protein and in marasmus to recover fat. However, it is easier clinically to detect a fat deficit than a protein deficit.

Whitehead agreed with Professor Ramalingaswami that the treatment of marasmic children tended to be more difficult than that of children with kwashiorkor. The problem in treating marasmic children seems to be that of getting in enough calories so that they can grow. Professor McCance made a big contribution to the treatment of marasmus when he showed that the slow rate of recovery in Ugandan children with marasmus was due to the fact that they were not receiving enough calories. Our marasmic cases, *Whitehead* said, get 4 g of protein and 200 kcal per kg per day and they have no difficulty in eating such

large amounts of food. In the case of much older children, i.e. 5–8 years of age, it is difficult for them to eat so many calories, and such rapid growth cannot be expected. Age is thus a factor which has to be considered in treatment efficiency.

Malmros asked if fat could be used instead of carbohydrate as a calorie source in the treatment of malnutrition. As a background to his question *Malmros* described some experimental work on rabbits. A diet containing 50% sucrose led to the development of arteriosclerosis and liver cirrhosis in one year despite the fact that it contained no fat or cholesterol. When fat in the form of corn oil or sunflower oil was used as a calorie source no symptoms or signs were seen from the liver even when the experiment continued for 1–2 years.

Viteri replied that one should not be afraid of using fat during recovery of children with kwashiorkor and/or marasmus. In fact 30% of the calories are given in the form of fat during treatment of kwashiorkor at INCAP with good results. A high carbohydrate intake could induce salt accumulation as there is less natriuresis during starvation when you give carbohydrate than when you give fat. Thus a child would be less oedamatous if he were receiving only fat rather than carbohydrate.

Whitehead agreed that fat could be fed during the treatment of kwashiorkor. In Uganda cotton seed oil which contains a lot of medium chain fatty acids is used. One of the big problems in the treatment of malnutrition is not getting enough protein into the child but getting in sufficient calories so that the protein can be efficiently utilized.

Ramalingaswami asked what happened to the insulin production when fat was given, and *Viteri* answered that this would not be stimulated.

Whitehead referred to the experimental work that had been done in dogs by Heard, Platt & Kreigsman (1969). They fed two groups of dogs, one on a low protein—high carbohydrate diet and the other on a low protein—high fat diet. A distortion of the amino acid pattern occurred when a low protein—high carbohydrate diet was fed but not in the group with a low protein—high fat diet. This would mean that insulin was working against the release of amino acids from tissues on the high carbohydrate diet but not on the high fat diet.

THE EFFECTS OF STARVATION ON THE FUNCTION OF THE FAMILY AND OF SOCIETY

by Derrick B. Jelliffe and E. F. Patrice Jelliffe[1]

The biological and psychological consequences of communal starvation on the function of the family and society plainly vary with many inter-connected circumstances, including *initial causes* (crop failure, war, severe disruption of communications), *the community's nutritional background* (previous general level of nutrition and health, population pressure, prevalent forms of malnutrition), *the culture pattern* (rigidity of food habits, concepts concerning life, death and causation of the disaster, family, kinship and political systems), *aggravating factors* (degree and duration of food shortage, lack of water, single or multiple epidemics in man and domestic animals, loss of shelter and adverse climate, "secondary disasters" (e.g. floods after drought), loss of human and animal working power, degree of family disruption (males in army, migration), breakdown of law and order, hoarding of food, with speculation and very high prices decreasing availability to the poor), and *ameliorating factors* (availability of national regional or global food reserves or surpluses, transport facilities, large scale emigration, effect on morale of likelihood of relief and availability of accurate news and information).

Plainly, the circumstances found in the siege of Leningrad (1941–1942) (Antonov, 1947), the refugee situation in cassava-eating populations in the Kasai, Congo (1960) (Lowenstein, 1962), the families of the Donner Party snowed-in in the Sierra Nevada Mountains (1846) (Keys et al., 1950), the Irish Potato famine (1846) (Edwards and Williams, 1956), the Nigerian Civil War (1967–1970) (Aall, 1970; Miller, 1970), and the most recent Bengal famine (1943) (Bhatia, 1967), all vary greatly.

In addition, observers and relief workers are usually concerned with trying to deal with overwhelming problems with limited resources in chaotic social conditions. The over-riding need for action makes detailed collection of statistical information difficult and somewhat of a luxury. Likewise, the human emotional need to deal with the suffering found may make the collection of data psychologically repugnant, unless gathered quietly as an integral part of relief operations. Unfortunately, there is rather little reliable detailed statistical information on the effect of starvation on communities, but techniques need be built into future relief operations.

Nevertheless, despite very contrasting circumstances in the thousands of famines and disasters that have plagued mankind throughout history, and despite the usual lack of precise numerical information concerning the effect on the function of families and society in most of them, certain overall generalizations appear warranted.

(*1*) *Biological effects*

As would be expected, communal starvation initially affects the physiologically vul-

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Fig. 1. Moderate PCM in two-year-old ("secotrant") displaced from mother's breast (Kigezi, Uganda). This "normally" vulnerable age-group is early and severely affected in famine.

nerable—young children (in the "weaning" or transitional period), the aged, the sick, and pregnant and lactating women.

Different forms of protein-calorie malnutrition of all kinds of severity (Jelliffe, 1959)—including marasmus and/or kwashiorkor—increasingly affect and kill among these groups, particularly the young children, especially the highly "at-risk" secotrant (two-year-old) (Jelliffe, 1969).

For example, in war-time Athens (1941–1942), Petrides (1948) recorded a high rate of "hunger oedema" in young children, 60% of whom were between 1–3 years of age; while Lowenstein (1962) has described an epidemic of kwashiorkor, mostly in young children, in African refugees in Kasai, Congo, in 1960.

Similarly, eye-witness accounts of the Irish potato famine also stress the age distribution of "famine dropsy":

"Frightful and fearful is the havock around me—the aged and the young—almost without exception swollen and ripening for the grave" (quoted from Edwards and Williams, 1956).

As the famine becomes more prolonged, older children and adults also become affected (Lowenstein, 1962; Yarom and Mc Fie, 1963; Bennet, 1969). Among these older age-groups, as in young children, malnutrition presents initially with decreasing weight, with wasting of body reserves of calories, in form of subcutaneous fat, and protein, in the form of muscle, especially apparent in the thin limbs (Bennet, 1969; Gurney, 1969; Arnhold, 1969; Davies, 1970). Ultimately, severe, fatal syndromes of PCM develop, including variants of

Fig. 2. Moderate and severe PCM in older children and adults (E. Nigeria).

kwashiorkor and marasmus. The clinical appearance of the latter has been well described by Digby (1878) (quoted by Edwards and Williams, 1956):

"The head looked unnaturally large by contrast with the emaciated trunk, the shoulder blades projecting as if they had been inserted by mistake in too small a carcass, the arms and legs shrivelled to the size of their bones, except at the knees which are swollen."

In the earlier stages of communal starvation, human lactation usually appears to be relatively little affected, so that breastfed babies are nutritionally protected. For example, in war-time Athens, Petrides (1948) found no "hunger oedema" in infants below 6 months of age, and was of the opinion that babies either received no breast milk and died, or obtained "basal" amounts of mother's milk and escaped.

This protective effect of breast feeding has also been noted in Rotterdam towards the end of World War II (Smith, 1947), in the Congo (Lowenstein, 1962) and in the siege of Leningrad, where Antonov (1947) observed that "as long as the mammary gland received sufficient physical stimulation, milk continued to be secreted, although the quantity might be reduced and the length of lactation shortened".

The relatively normal—or only somewhat reduced—levels of proximate principles, especially protein, in the breast milk of mothers early in famine or semi-starvation (Gunther and Stanier, 1951) parallels results obtained from lactating women in habitually poorly nourished communities (Gopalan and Belavady, 1961; Bailey, 1965; Underwood et al., 1970).

However, as well recognized, the capacity to lactate is as much related to psychological factors as to nutrition, and, in large scale disasters, maternal anxiety and the necessity of breast feeding for her offspring's survival are opposing emotional forces.

More usually, mothers are able to lactate well in early famine circumstances. The incidence of breast feeding is reported to have increased during the siege of Paris in 1876, with a *decline* in infant mortality, despite rising mortalities in other age groups (Newman, 1906). Similarly, in Japanese internment camps, European and American women all breast-fed their babies successfully for about one year (Williams, 1947).

However, when *severe* chronic maternal malnutrition has developed, lactation declines and eventually ceases, so that young infants cease to be protected, and become highly vulnerable to marasmus and diarrhoeal disease (Kerpel-Fronius, 1947; Lowenstein, 1962).

Biologically famine also leads to widespread amenorrhoea, and to increased rates of stillbirths and of low birth weight babies (and hence neonatal deaths) (Antonov, 1947; Smith, 1947).

Starvation amenorrhoea has been dedescribed as a "convenience" (Grieve, 1946) and certainly has protective functions in that the "nutritional loss" of menstrual blood is conserved. It is also accompanied by infertility and, especially as it is associated with decline in libido, results in a marked drop in birth rate (Hytten and Thomson, 1965; Aall, 1970).

The prevalence of overt vitamin deficiency disease in the community depends in considerable measure on the customary background diet—and, hence, physiological stores. Initially, vitamin deficiency diseases are usually not a major feature. However, ultimately scurvy, pellagra, beri beri etc. may add to the nutritional misery. For example, in the Irish famine, scurvy occurred as a result of the severe shortage

of potatoes, the main local source of ascorbic acid as well as calories.

Paradoxically, in some communities customarily living on a limited, monotonous diet, the intake of some vitamins may even be increased, at least initially, as the range of foods taken is widened to include various wild berries, fruits and green leafy plants.

Also in children, the growth failure characteristic of all degrees of protein-calorie malnutrition may mask shortages of vitamins, such as vitamin A. This should be borne in mind during rehabilitation as the recommencement of growth and normal metabolism may lead to clinical avitaminoses—as, for example, keratomalacia and blindness—unless covered by adequate vitamin intakes.

In famine circumstances, the resulting malnutrition, together with various consequences of social disorganization—such as overcrowding, breakdown of sanitation, increase in vermin (rats, lice), inability to bury the dead, and uncontrolled movement of population—favour the outbreak of epidemics of infectious diseases, such as classical "famine or road fever" (typhus and relapsing fever), dysentery and other forms of diarrhoea, typhoid, tuberculosis, etc. as well as so-called childhood infections, including measles and whooping cough.

Malnutrition in a community not only lowers resistance to infection, but infections also make existing malnutrition worse. Nutrition and infection are, in fact, inextricably interwoven, with resultant increased mortality (Scrimshaw et al., 1968)—for example, Mayer (1970) has noted a 50–70% death rate in measles in children in Eastern Nigeria.

(2) *Psychosocial effects*

In famine-prone countries, even the apprehension of widespread food shortage leads to predictable behaviour—hoarding of food, rising prices, and movement of population towards areas considered less likely to be affected.

Despite great differences in circumstances, human starvation always produces a similar general pattern of change, present to some extent in the volunteers in the Minnesota starvation experiment (Keys et al., 1950) as well as in real life famines.

Initially, biological enfeeblement, related to a lowered metabolic rate and to wasting of muscle and fat, is compounded by apathy, depression, lack of initiative, decreased libido, dulling of emotions and poor concentration.

In the course of famines, individual, or even mass, suicide may occur, but according to recorded accounts, appears to be surprisingly rare, perhaps especially in Oriental countries.

In the final stages, the "immobility of the starved" becomes extreme, with gross wasting (with or without oedema), diarrhoea, loss of appetite, exhaustion and death.

During the earlier phases of starvation, all remaining energies and ingenuity are concentrated on the seeking of food to deaden "the persistent clamour of hunger" (Keys et al., 1950).

There is an extreme narrowing of interests, so that food is the sole focus of thoughts, ideas, interests and activities. The major part of the waking hours are concerned with food gathering, particularly for the community's "cultural super-food" (Jelliffe, 1968).

Even in the most conservative societies, the range or items eaten is widened to include usually unused foods. European pris-

Fig. 3. Food-gathering the exclusive activity in famine, especially the "cultural super food", as with the potato in Ireland.

oners of war in Japanese camps consumed rubber tree seeds, pine needle tea, melon and pumpkin rinds, and grass and leaf extract (Smith and Woodruff, 1951), while in past famines in various parts of the world, anything potentially edible has been eaten, including seed stores, wild roots, weeds and tree bark, rats an exhumed animal carcasses, sawdust, earth, manure and human flesh.

Necrophagia appears to be less common in Oriental countries, especially India, perhaps because of deep rooted religious fatalism and vegetarianism.

Various forms of extending—or increasing the bulk of—foods will be employed. For example, the Minnesota volunteers adopted the habit of "souping" their diet, with hot water to increase its bulk and warmth (Keys et al., 1950); while bread—the main food in the siege of Leningrad—was based on defective rye, extended with malt, bran and cellulose (Antonov, 1947).

Severe food shortage is accompanied not only by rising prices, but also by revaluation in general, so that assets are valuable only in relation to their ability to procure food.

The pressure by famine towards purchasing and eating the normally unacceptable, even at exorbitant prices, is stressed historically by the famine in besieged Samaria when:

"... an ass's head was sold for four score pieces of silver, and the fourth part of a cab of dove's dung for five pieces of silver" (Kings II. 6. 25).

Any activity which can obtain food may be employed ultimately, including theft, riots, prostitution and the selling of children. At the same time, the geographical range of food-seeking activities will be increased, leading to the movement of population, with the further spread of infection and with decreased possibility of agriculture, and with the progressive abandonment of the sick and the immobile, including children.

The psychosocial effect of famine on the disorganization and deterioration of the family and socity is progressive. Initially, there will be mutual help between kinship groups or friends, and attempts at preferential treatment for the vulnerable, including children.

However, as famine progresses, normal social behaviour disappears increasingly, including personal pride and family ties, leaving only increasingly self-centred "survival of the fittest" activities.

The breakdown of normal human relations and deviation from customary mores occur in all severe famines particularly so in the planned terror and degradation of concentration camps (Mollison, 1946).

Fig. 4. The major victims of famine—a cartoonist's summary.

The 13th century account of famine in the Chronicle of Novgorod, although much quoted, deserves repeating, as it so vividly portrays the family disruption (from Keys et al., 1950):

"A brother rose against brother, a father had no pity for his son, mothers had no mercy for their daughters; one denied his neighbour a crumb of bread. It was a bitter sight, indeed, to watch the crying children begging in vain for bread and falling dead like flies".

In the society as a whole, the pattern of family breakdown is seen in magnified form, with "anti-social" activities to obtain food, such as theft and "grain riots", only held in check by existing law enforcement (if such exists) and, ultimately, constrained by lethargy and weakness, by enfeeblement and death due to starvation and infection.

Accompanying famine, there will be a varying degree of breakdown or overwhelming of social services, including health care, water supplies and other aspects of environmental sanitation, and communications.

The community is also likely to have been disrupted by movement of population in search of food, by the breakdown of families, and by military activity or civil disturbance.

Also, as is well-known, "famine breeds famine" (Masefield, 1963), and food production in affected regions is secondarily diminished by many factors, including the decreased and enfeebled human and animal work force, the movement of population and the loss of seed stores.

Conclusion

Widespread famine can lead to a devastatingly high general mortality, as in Ireland in 1845–1849, when over a million died (Edwards and Williams, 1956; Woodham-Smith, 1962), or, even worse, in the various huge disasters over the centuries in India and China (Passmore, 1951).

Often details of the age groups most affected are not given in historical accounts of famines. However, recent evidence clearly confirms that the major brunt of both biological and psychosocial effects of communal starvation falls earliest, most severely and most extensively on the physiologically vulnerable—the aged, pregnant and lactating women and especially young children (Mayer, 1970).

Protein–calorie malnutrition of early childhood of increasing severity and mortality becomes so prevalent as to be termed "epidemic" (Lowenstein, 1962), and, in severe famine, selectively erases the young child segment of the population. Thus, late in the Nigerian war, Aall (1970) comments that "one hardly sees children aged between 6 months and five years".

The long-term effect on survivors of such widespread family disruption, disorganization of schooling and severe malnutrition in early childhood on the subsequent mental and physical development and ability of whole communities is speculative, but alarming (Winnick, 1969; Widdowson, 1970).

Conversely, it follows that the nutritionally vulnerable groups, especially young children and pregnant and lactating women, need special and priority attention during relief operations in large scale disasters and famines.

The prime need is for the selective distribution of appropriate foods, rich in calories, protein and vitamins (Jelliffe, 1969) for young children *and* for pregnant and lactating mothers. The latter are a priority group because of their own nutritional vulnerability, and because of the need to permit mothers to continue the production of the most vital emergency food for young babies—breast milk.

Also, as deaths in famine usually result from a mixture of malnutrition and infection, it will be necessary to set up a simple system of adaptive MCH services (Jelliffe and Jelliffe, 1970) as soon as possible, capable of the recognition and basic treatment of the main infections present and appropriate immunization, as well as the issue of emergency supplies of food to those principally in need.

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Rapporteurs: K. E. Knutsson and Y. Hofvander

The discussion was opened by *Mayer* who stressed four points of importance based on impressions from Eastern Nigeria. He first stressed the enormous rate of lost children along the roads and the element of grief which naturally comes in here. There may be near suicide by self-inflicted starvation. The small children won't eat because the parents are not around. *Mayer* would suggest some type of emergency identity disks which would help to identify and bring back lost children.

Secondly he stressed that one could remember that adolescents play a very special role. If social disintegration sets in and there is shortage of food, gangs will be formed to forage for food. Rehabilitation after the famine may by very difficult.

The third point concerned vital statistics under disaster circumstances. It is even more difficult to get some data on birth-rate down to less than half of the normal in the Nigerian crisis.

The final point referred to Dr Aykroyd's words about the victimized situation of the elderly. It should be remembered that old age for purposes of a famine starts in most cases at about 45 years. From that age there was in the Nigerian situation a drastic increase in mortality as compared with adult men and women below that age.

Ifekwunigwe confirmed that lost children constituted a great problem in the Nigerian crisis. One had tried to use identification disks laid out in various ways. The best one was a plastic identification disk hung around the neck or wrist. By this it was possible in some or most cases to identify children who were too young to identify themselves. *Ifekwunigwe* also confirmed that the decreasing birth-rate was visible and was due to many factors, among them malnutrition leading to amenorrhoea and also to crowded conditions in the camps, not suitable for reproductive activities. When pregnancy took place the incidence of miscarriages was also markedly raised.

The question of the chemical composition of mother's milk during starvation was raised by *Malmros*. *Jelliffe* stated that he thought the last word had not yet been said. As far as he could see, in fully nourished communities the protein and perhaps the fat content of breastmilk remained remarkedly constant whereas vitamins seem to depend on the mother's diet and her immediate stores. In situations of more severe malnutrition we know less. There is increasing evidence that there is further decrease from normal to below that as far as protein and calories are concerned. In moderate malnutrition the composition remains relatively normal. In severe famine there tends to be a drying up of mother's milk although it is not known of any recent investigations on the composition of breastmilk in very severe starvation. This last statement was also confirmed by *Ramalingaswami*.

Ifekwunigwe said that in Nigerian crisis the breastfed children under one year were initially protected. Later these also became malnourished because the mothers slowly became victimized and not able to produce enough milk. The next group to suffer were the people over sixty. It was not unusual to find in some institutions that the majority of patients were very old. Referring to Jelliffe's description of the breakdown of the social structure Ifekwunigwe thought that the traditional system to start with contributed to protect the children but slowly this protection broke down as the traditional responsibilities of parents and kin broke down. One conclusion is that one cannot rely on the parents to administer the assistance in the form of food etc. because they are also in need.

Forman emphasized that we had to identify carefully the type of disaster we are talking about.

1. The emergency disaster due to a national calamity of some kind which occurs rather suddenly.
2. The creeping disaster due to famine when there is time to prepare for a counterattack.
3. A combination of the two which was often seen in Nigeria.

We know enough about cultural differences, about the esteem in which children are held, about the size of families and the distribution pattern within families and so on. How-

ever, Forman asked whether we really know enough. It seems that we keep repeating the experiences of some few disasters. Do we know enough to make generalizations? He recommended the building in the future of a systematic type of system that makes it possible for collection of further information. There is a need for guidelines for collecting this type of information.

Jelliffe agreed to this point. He thought we had sufficient approximate information but we need to know more. And further documentation is obviously needed. For instance, how long would a famine continue before the people in this particular part of India (Bihar) did eat millet or would they never have eaten it?

Ramalingaswami confirmed that people would rather starve than eat millet in the Bihar famine. He also stressed that usually the very young and the elderly suffer most. But if the famine is severe this age differential may be wiped out and young adults and old children may also be affected. The working class adults who go for "food for work" programs and work all day long would show hunger oedema in the evenings. One major problem had been that people had been asked to come to a relief centre. The poor will go there. The middle class may also suffer because they do not want to go to the relief centre together with people who are regarded as socially inferior.

Forman again stressed the importance of collecting much more information. There is an average of 40 disasters a year and a wealth of data and information could be gathered.

FAMINE, INFECTIONS AND EPIDEMICS

by William H. Foege[1]

Introduction

History has wedded famine and pestilence in a special and devastating manner. From writings as early as 700 B.C., the association of infectious disease outbreaks in times of famine has been noted (McCance, 1951). Experience suggests the frequent simultaneous occurrence of famine and epidemics is not coincidental. Rather, famine with a high degree of predictability leads to a triad, including not only epidemics but also deaths due to starvation and social disruption (Fig. 1). This triad is perpaps best immortalized on a monument located near Quebec and dedicated to victims of the Irish Potato famine. The inscription reads ... "In this secluded spot lie the mortal remains of 5 294 persons, who, flying from pestilence and famine in Ireland in the year 1847, found in America but a grave" (Woodham-Smith, 1962).

The problem of infectious diseases in times of famine involves two definable mechanisms. One, there are indications that malnutrition often results in a more severe clinical infection. Second, the social disruption, crowding, and decrease in sanitation often fostered by famine enhance the transmissibility of many infectious diseases (Fig. 2).

The present discussion will consider the evidence for increased severity of infections in malnutrition, some historical evidence of increased transmission of infectious disease in famine, the possibility of aborting or preventing famine epidemics and the implications of these factors on a relief program.

Increased severity of infectious diseases in situations of malnutrition

First, it must be understood that famine is itself an epidemic; an epidemic of malnutrition. Therefore, the lessons learned from areas of endemic malnutrition or seasonal malnutrition have certain applicability to situations of epidemic malnutrition, which we call famine.

Measles, because of its recent role as a famine disease in Nigeria, deserves special attention. Extremely high death rates from measles have repeatedly been reported from West Africa (Morley, 1962; Morley, Woodland and Martin, 1963; McGregor, Billewicz and Thomson, 1962; Morley and Mc Gregor, 1964). Although early reporters suspected the difference in mortality between Africa and Europe was due to a different virus or climatic conditions, many writers now recognize and emphasize the striking relationship between malnutrition and the degree of severity of measles (Rey, 1967; Ogbeide, 1967; Morley, Martin and Allen, 1967). In Nigeria, it has been shown that children from elite Nigerian families do not incur the same risks of measles mortality as do children from lower socioeconomic families and that there is a strong relationship between measles deaths and low weights prior to the onset of measles (Hendrickse, 1967). Mortality rates have been found to increase in situations of poor nutritional status with mortality rates

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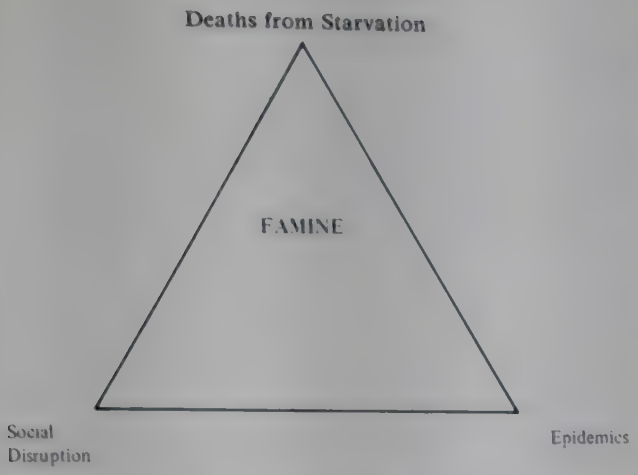

Fig. 1. The famine triad.

as high as 50% in a measles epidemic involving children undergoing therapy in malnutrition treatment centers (Conrad, 1969). Hendrickse (1967) has summarized the opinion of many when he writes "it must be concluded that interaction between malnutrition and measles is strongly synergistic, and that malnutrition is probably the major determinant of the serious prognosis of measles in West Africa".

Tuberculosis increases in frequency in times of famine but also tends to progress more rapidly in malnourished patients (Keys, 1950). Diarrheal diseases occur more frequently and last longer among the malnourished. Studies have shown that a low weight for age renders young children highly susceptible to gastrointestinal infection (Whitman, Moodie, Hansen and Brock, 1967; Gordon, Guzman, Ascoli and Scrimshaw, 1964). An increased severity of other infections, including hepatitis, Herpes simplex, and typhus fever, has been recorded (Scrimshaw, Taylor and Gordon, 1968).

Although a decrease in severity of malaria in the malnourished has been reported (Hendrickse, 1967; Ramakrishnan, 1954), the converse has also been noted with malaria epidemics occurring during severe famine conditions, such as the 1935 famine in Ceylon (Frederiksen, 1970).

Numerous studies on man and animals showing the relationship between specific nutritional deficiencies and the disease producing capacity of specific organisms have recently been summarized (Scrimshaw, Taylor and Gordon, 1968). While specific nutritional deficiencies may inhibit the disease producing capacity of certain organisms, particularly viruses and protozoa, the authors feel the majority of evidence supports the conclusion that multiple nutritional deficiencies and protein deficiencies enhance the ability of infectious agents to produce disease. The mechanisms involved in synergism between nutritional deficiencies and infection are discussed by the same authors (Table 1).

The practical implications of these studies for relief workers are:

1. The nutritional state of an individual is often the deciding factor in the severity and the outcome of a particular infection. Severe clinical infections and higher case fatality ratios may, therefore, be seen in times of famine.

2. It is possible that increased severity in clinical illness may in some circumstances and in some diseases lead to increased transmission rates.

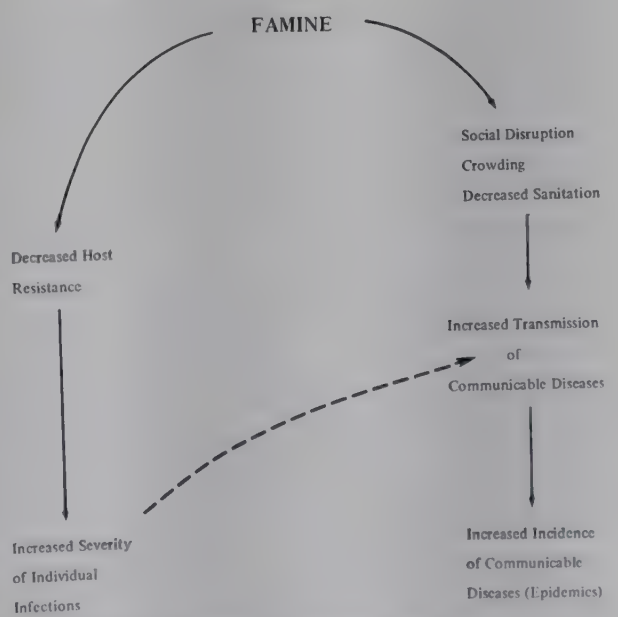

Fig. 2. Some effects of famine on communicable disease epidemiology.

TABLE 1. *Mechanisms decreasing resistance of malnourished individuals to infection.*[a]

Reduced capacity for antibody formation
Reduced phagocytic activity
Reduced epithelial tissue integrity
Reduced capacity for wound healing and collagen formation
Altered intestinal flora
Endocrine imbalance

[a] Scrimshaw, Taylor and Gordon (1968).

Increased transmission of infectious diseases during famine

"In most famines, deaths from epidemic diseases have far outnumbered deaths from starvation" (FAO No 21, 1967). In addition to higher case fatality ratios, more people as a rule acquire infections diseases during famine. As noted before this increase in transmissability is due to social disruption and its resultant crowding and decreased attention to sanitation.

Epidemics of any infectious disease may be associated with famine. Louse-borne typhus has been the great famine disease in Europe, while cholera and smallpox have been the traditional famine scourges in Asia (Davidson and Passmore, 1966). Other prominent famine epidemics have involved scarlet fever, plague, pertussis, diphtheria, dysentery, measles, typhoid, and tuberculosis (Keys, 1950; McCance, 1951).

The ancient association of famine and pestilence has been mentioned. No attempt will be made here to summarize the enormous literature on the topic. Several highlights will serve as examples. The first great plague epidemic of the 6th century was preceded and accompanied by a succesion of earthquakes, volcanic eruptions, and famines (Zinsser, 1935).

The crusades were often molded by famine and epidemics. Pestilence and famine reduced an army of 300 000 to 60 000 during the siege of Antioch in 1 098 (Zinsser, 1935).

The story becomes repetitious as thousands die of plague and typhus during the Russian famine of 1 602 and in Italy after the Thirty Years' War famine gave typhus "a free hand in some of the most severe epidemics of its history" (Zinsser, 1935).

Military sieges have repeatedly provided the laboratory for testing the combined effects of famine and superimposed diseases. The siege of Danzig (1813) resulted in 20% mortality among 36 000 defenders within a 60-day period. Lack of food and the spread of epidemics resulted in 30 000 French military deaths in less than 5 months during the Torgau siege (1830). During the siege of Paris in 1870–1871, a decreasing food supply led to periodic reductions in daily food rations from the initiation of the siege on September 19, 1870, until armistice on February 4, 1871. The week prior to the armistice was associated with a death rate five times the expected, as compared to previous years, with smallpox, typhoid fever, dysentery and diarrhea, pneumonia, and bronchitis accounting for over 40% of the 4 671 deaths in that week (Prinzing, 1916).

The Irish famine of the 1840's provides a well-documented account of epidemics in a debilitated population. The association between epidemics and famine was well-known and, therefore, the British Government made provisions for extra hospitals, dispensaries, and medical officers following the first failure of the potato in 1845. The Central Board of Health did not consider an epidemic to be imminent and, disregarding government directives, they made no preparations for this possibility. The second and total potato failure was followed in early 1847 by a "fever epidemic", the most important ingredients being typhus

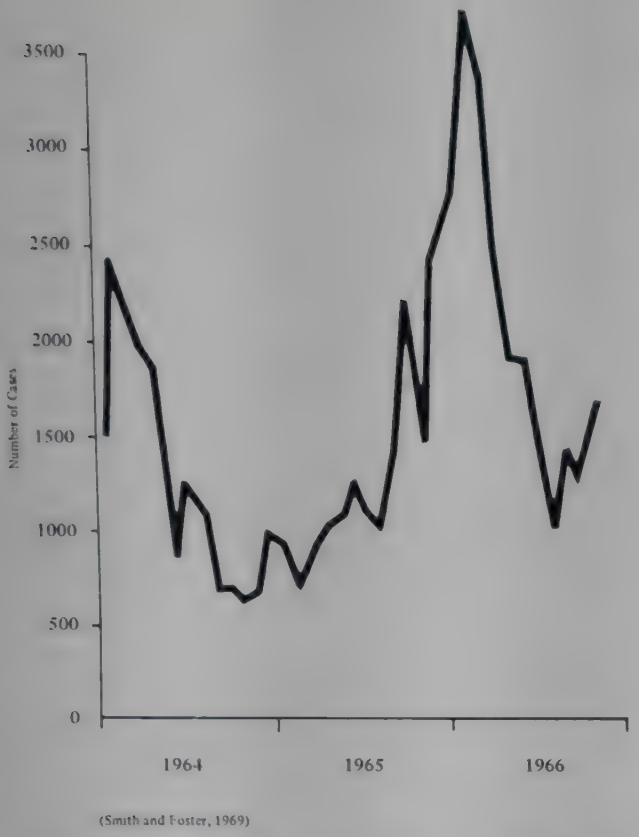

Fig. 3. Measles in Eastern Nigeria, 1964–1966.

and relapsing fever. Throughout 1847, deaths from "famine fever" continued at such a rate that clergymen reported the number of dead could not be ascertained and mass funerals were the rule. It is estimated that about "ten times more died of disease than of starvation" (Woodham-Smith, 1962). The literature is rich with similar accounts. In general, if a famine involves large numbers of people over a protracted period, the question is not "will there be an epidemic?" but rather "what will be the agent?"

Are epidemics inevitable in times of famine?

Although epidemics are historically inevitable, there have been noteworthy recent exceptions. Despite widespread starvation in Greece in 1942 and in Holland in 1945, no real epidemics developed. Even in the Warsaw Ghetto, with extreme malnutrition and almost 300 000 deaths, epidemics were very rare (Keys, 1950).

It is clear that early attention to sanitation and disinfection can reduce the risk of an epidemic and it is also clear that prompt and appropriate reaction to the first indications of an epidemic can reduce its impact.

In Eastern Nigeria, prior to the war, measles was an endemic disease with superimposed epidemic periods every 2 to 3 years. During epidemic years, such as in 1964 and 1966 (Fig. 3), the epidemics would generally last 4 to 6 months. In late 1968, surveillance of measles was reinstated in federally occupied areas of the three eastern states, using medical and nutritional relief teams as the reporting units. No major epidemic had occurred in these particular areas for several years, therefore, a marked accumulation of susceptible children had developed. During the first week of January 1969, an increase in measles reports was noted. Federal and state health officials were prepared for the possibility of a measles epidemic and immediately launched a mobile vaccination program to immunize children in high risk areas. Instead of the expected epidemic of several month's duration, it can be seen (Fig. 4) that the epidemic was aborted within 1 month. Within a given village (Fig. 5), the measles epidemic was halted within one incubation period of the vaccination campaign.

Implications for relief operations in times of famine

Given a decreased resistance to infections in the malnourished, an increased risk of transmission because of the many factors commonly associated with famine, considerable historical evidence that infectious disease epidemics are commonly coexistent with famine, and the observation that in

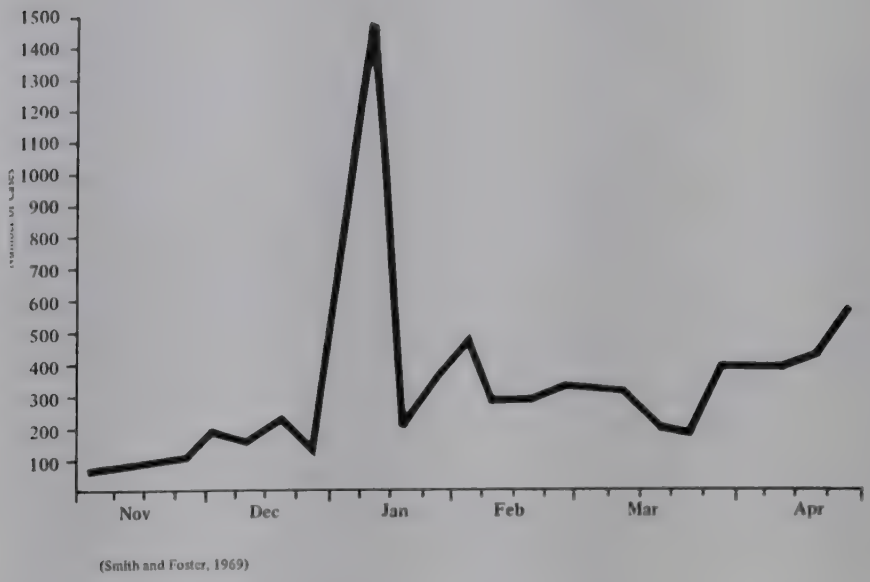

Fig. 4. Number of cases of measles in eastern states by weeks—November 1968 to April 1969.

many famines the terminal event is more likely to be an infectious disease than simple starvation, the implications are clear. Preventive and remedial action for infectious disease epidemics must receive the same priority attention given to food distribution. This requires application of the same principles which would be used in disease control in non-famine situations, namely, surveillance, analysis of surveillance reports, action, and assessment (Table 2).

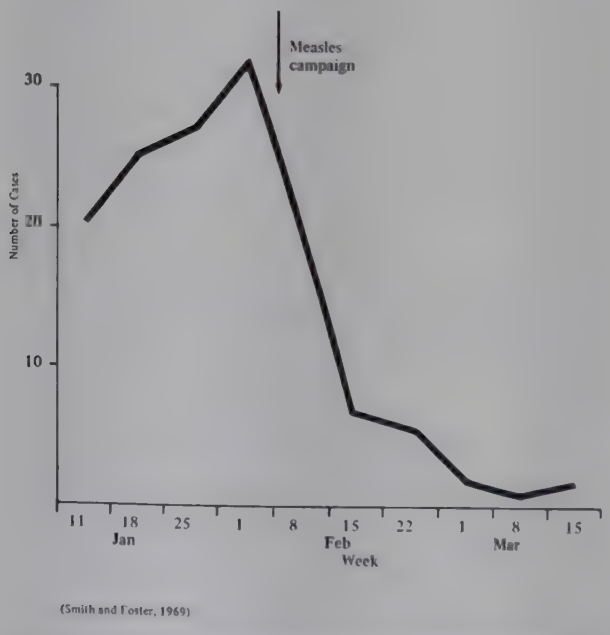

Fig. 5. Effect of measles vaccination campaign on epidemic in Ugbowo village.

Surveillance is the key to famine relief. Many aspects of famine relief including caloric diets and responses to various epidemics can be planned in advance, but only

TABLE 2. *Guidelines for disease control in times of famine.*

Surveillance of selected diseases
Limit to serious diseases likely to occur in area involved
Give priority to diseases amenable to control procedures
Provide for frequent positive and negative reporting from field units
Analysis of surveillance reports
Collate reports at central facility
Interpret significance of reports and decide on required action
Immediately investigate threatening disease situations
Action
Prepare plans for epidemic possibilities
Stockpile vaccine and therapeutic agents
Allocate transport, equipment, and personnel for epidemiologic investigation and control activities
Initiate control activities at earliest possible time
Assessment
Evaluate efficiency of surveillance system
Evaluate effectiveness of control procedures

surveillance can tell what is the situation to which we must react. Many of the historical mistakes in famine relief have resulted from inadequate and inaccurate information. Just as the nutritional aspects of famine relief require accurate information on deaths and malnutrition by geographic area and age, together with information on local food availability and required food imports, so do the infectious disease aspects or famine relief require accurate information on the geographic occurrence of infectious diseases over time. The selection of reporting units will vary from one relief situation to another, but will usually include combinations of relief teams and existing health facilities or special health facilities such as malnutrition treatment centers. Requests for information on a large variety of diseases are likely to reduce the quality and quantity of information on the most important infectious diseases. Therefore, it is useful to limit reporting to serious diseases likely to occur in the area. Also, if choices must be made between certain diseases, priority should be given to diseases amenable to control procedures.

Positive reporting systems, that is, systems which report only if cases of a particular disease are seen, often misinterpret "no report" for "no disease". Many errors are possible from forgetting on the part of the reporting agent, to loss of the report en route, or incorrect recording of the report after receipt. Therefore, it is important to institute a system which clearly reports the absence of disease as well as its presence and allows for three interpretations. First, the disease is present; second, the disease is absent for the stated time period; or third, no reports were received from the given area for the time period in question.

Surveillance reports must be interpreted in order to be useful. This includes collating reports for the entire relief area and interpreting the significance of the reports, whether action is required, and the type of action required. The central epidemiologic unit must contain personnel with competence and experience in investigating and controlling infectious disease outbreaks. In the case of certain reports, such as smallpox and cholera, immediate investigation must be made to determine whether the report is accurate, and if accurate, to institute immediate control procedures.

A responsibility included under surveillance and analysis is to not only collate reports for the use of a central office but also to return information on the entire relief action to the participating relief teams. This is not only useful for improving the knowledge, coordination, and effectiveness of relief teams, but it is also necessary if teams are to be motivated to continue reporting. Table 3 is a randomly selected surveillance report, issued each week by the Nigerian Red Cross, which summarizes for the week the number of people receiving food by geographic location and type of feeding, the tonnage distributed by geographic area, the number of patients treated each week by geographic area, and the geographic breakdown for selected communicable diseases which were being reported at that time. This type of feedback system is a vital link in famine surveillance systems.

The next segment of the surveillance arc, action, ideally requires a plan of operations prior to an actual epidemic. Such a plan would detail the responsibilities of various people and the course of intended action. Effective action would require either stockpiling certain vaccines and therapeutic agents at the central facility or making previous arrangements to secure selected vaccines and therapeutic agents within a short period of time. Transportation, equipment,

TABLE 3. *Relief action surveillance report for week ending April 12, 1969.*

	Geographic area				
	Enugu	Uyo/Calabar	Rivers	Mid-West	Total
Malnutrition and food distribution					
People receiving food					
People receiving several meals daily	2 375	991	472	0	3 838
People receiving daily rations	33 937	38 018	10 937	600	83 492
People receiving weekly rations	330 872	149 939	41 447	20 429	542 687
Total	367 184	188 948	52 856	21 029	630 017
Food distributed (in tons)					
Carbohydrate food	120.0	85.5	88.0	62.0	355.5
Protein food	244.3	67.0	34.6	81.0	426.9
Other food	5.5	2.9	7.8	0.0	16.2
Total	369.8	155.4	130.4	143.0	798.6
Treatment programmes					
Malnutrition					
Inpatients	744	840	131	—	1 715
Outpatients	852	3 136	1 533	—	5 521
Subtotal	1 596	3 976	1 664	—	7 236
Other medical patients	17 721	5 089	1 687	—	24 497
Total	19 317	9 065	3 351	—	31 733
Communicable diseases					
Smallpox	0	0	0	—	0
Measles	56	318	1	—	375
Whooping cough	11	77	2	—	90
Meningitis	0	0	0	—	0

Source: Nigerian Red Cross, April, 1969.

and personnel, both for epidemiologic investigation and control activities, must be allocated in advance. The significance of an epidemic may not be appreciated by all people when it threatens or early in its course, and clear contingency plans must be developed in advance to ensure that the proper input of resources is available at the earliest possible time. If early in an epidemic time must be lost convincing a relief administration of the importance of action, the opportunity for effective action may be irretrievably lost.

A final step frequently missing from relief plans is assessment. To know that the surveillance system is indeed sensitive to infectious disease occurrence, personnel must be available to conduct independent surveys on both the nutritional status of the population and the presence or absence of infectious disease. Whether talking about the nutritional status or disease status of an

area the important point is to avoid roadside surveys. Both situations will be found quietly in the huts. The successful surveillance agent will be the one who knows where to look.

Assessment must also be built into every control action. If the control action involves an immunization campaign, and if smallpox vaccination is an indicated part of the campaign, assessment can very easily be done one week later by randomly assessing for the presence or absence of a developing vaccination reaction. If smallpox vaccination is not indicated, an artificial marker can be used by dipping the fingers of recipients in a dye solution, allowing for assessment some hours or days later. In either case, campaign effectiveness must be objectively measured and remedial measures taken to correct deficiencies.

Summary

A close association between famines and epidemics has been noted historically. Two different mechanisms have been described to explain, in part, why infectious diseases become of great significance during times of famine. First, numerous studies have supported the conclusion that multiple nutritional deficiencies and protein deficiencies enhance the ability of infectious agents to produce disease. Second, social disruption, crowding, and a decrease in sanitary standards have frequently resulted in an increase in transmission of infectious diseases during famine.

Experiences during the second World War have shown that epidemics can be avoided with increased attention to sanitation, and experiences during the Nigerian war have shown that epidemics can be limited by rapidly applying control procedures.

Relief operations must regard disease control as a high priority. The key to effective disease control in times of famine is surveillance of selected diseases, using a positive and negative reporting procedure. Surveillance reports must be interpreted and immediate investigation made of unusual disease occurrence. Surveillance reports should periodically be summarized for distribution to reporting units. Operational plans for disease control should be prepared early with advance allocation of transportation, equipment, and personnel for epidemiologic investigation and control. Finally, assessment procedures must be instituted to measure the efficiency of the surveillance system and the efficacy of control actions.

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Summary of Discussion

Rapporteurs: K. E. Knutsson and Y. Hofvander

The discussion was opened by *Passmore* who congratulated Foege on an excellent presentation.

Ramalingaswami referred to the diagram showing the mechanisms of reaction to injury in protein depleted organisms. There is evidence now that the reaction to injury as it involves multiplication of cells in the fibrovascular system and fabrication of protein are both quite significantly affected in a protein-depleted organism. The doubling time of the immunologically competent cell in the spleen is markedly prolonged in the protein depleted state. Immunity is quite markedly disturbed in protein depletion. However, there is still much to learn about these mechanisms.

Ifekwunigwe emphasized the severity of measles in West Africa. There is an overall mortality of about 5% (up to 25% of those admitted to hospital for complications). If a measles epidemic had been superimposed on the malnutrition situation on top of the crisis in Nigeria this would have caused a catastrophic situation.

Viteri reported that measles seems to be one of the most severe forms of infection in terms of nutrition in Guatemala. It had been possible to quantitate the nitrogen losses in children admitted to a metabolic ward before being infected with measles. 7 children were followed during the whole measles period and were found to loose up to 10–12% of their body protein during hospitalization for measles. One can imagine that the loss may be even greater in the general population than in hospitalized individuals. The Guatemalan experiences from vaccinating smallpox in severely malnourished children had not been good at all. There had been two local disseminations of smallpox vaccine in severely malnourished children. One would hesitate to vaccinate under such circumstances. The granulomatous reaction to a skin blister had been studied at INCAP and it had been found a defective organization of fibrovascular tissue as also had been mentioned by Ramalingaswami. The severely malnourished child has very large amounts of IgA which may be a secretory immunological entrance from the intestines or the respiratory tract. In spite of a high gammaglobulin in infected children the production of immunoglobulins may be impaired.

Vahlquist stated that communicable diseases represent one of the most serious mechanisms precipitating malnutrition. Much more intense work should be made already in peace time through mass vaccination campaigns. He expressed the opinion that people interested in communicable diseases and those interested in malnutrition were not sufficiently close to each other. Mass campaigns against communicable diseases should definitely also be considered as a weapon against severe malnutrition. This seems to be the view of WHO.

Bengoa agreed with this. In programs in West Africa over the past three years 122 mill. people have been vaccinated against

smallpox and 21 mill. children against measles. This is in line with WHO policy that also aims at such preventive campaigns.

Foege ended the discussion by stating that the administration of smallpox vaccine to 110 million persons in West and Central Africa in the past four years had not given reason to believe that malnutrition is a contraindication to vaccination or that complications are more frequent in malnourished patients.

TREATMENT OF SEVERE INFANT MALNUTRITION

by F. Mönckeberg[1]

During the last few years many papers related to the treatment of infant malnutrition have been published, but it is very hard to reach any final conclusions, because the results are often contradictory. Certainly, the problem does not seem to be solved even today, since even among children admitted to hospital, mortality rates of up to 30 to 50%, have been reported (1, 3).

The high risk for the infant consequent upon severe malnutrition results mainly from three factors: (*a*) malnutrition produces numerous metabolic alterations which affect the mechanism of absorption and utilization of the different nutrients; (*b*) malnutrition affects the immunologic mechanisms of the infant, producing as a consequence a high susceptibility to infections; (*c*) malnutrition affects the mechanisms of water and electrolyte balance, producing hydrolability and serious electrolyte disturbances. All of this explains the high mortality rate among severe malnourished children, even in hospitals where the medical resources are adequate.

Caloric needs

The chronic restriction of the caloric intake in marasmic patients produces numerous biochemical alterations (4). Recovery of infants suffering from severe marasmus is generally slow and difficult (5). When hypoalimentation has been of long duration and has caused severe malnutrition, the recuperation process takes a long time for weight gain to start even when there are no signs of infection, parasites or other concurrent disease. It is common experience that for 4 months or more, neither clinical improvement nor a rise in weight may be observed in these patients spite of a diet providing calories in amounts that are adequate for a normal child (120 cal/kg/day). During this period the nitrogen balance may be negative or only slightly positive, even when the absorption of nitrogen is normal (6) (Table 1). The basal oxygen consumption is below normal and does not increase until recovery starts (7) (Fig. 1).

Some authors have pointed out that during this period the calorie intake should be increased considerably (over 150 cal/kg/day) in order to obtain a significant weight increase (8–9). In our experience, infants 4 to 11 months old, with severe marasmic malnutrition and free from other additional pathological conditions, need a larger amount of calories per kilogram of body weight in order to attain weight increases similar to those of normal infants (Table 2) (11).

During the first weeks of treatment the calorie "efficiency", expressed as the relation between calorie intake and weight increase, is low and it takes about 6 weeks to reach an approximately normal value (11). However, if the calorie intake is increased, the calorie efficiency improves remarkably (Fig. 2) even during the first week of treatment. Based on these results it can be concluded that infants with severe marasmic malnutrition suffer from a functional or metabolic disturbance which is evident by

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TABLE 1. *Balance data on severe marasmic malnutrition before recovery start.*

Case no.	Ingestion	Urine	Fecal	Retention (%)
Phosphorus data (mg/kg/day)				
1	169	76	79	8
2	140	61	54	17
3	210	94	99	5
4	231	110	111	4
5	167	92	74	0
6	169	87	81	0
Average	181	86	83	5
Potassium data (mg/kg/day)				
1	390	351	31	2
2	410	312	39	12
3	429	390	27	2
4	545	390	35	22
5	429	390	19	4
6	390	351	19	5
Average	430	364	28	8
Nitrogen data (mg/kg/day)				
1	750	650	100	0
2	718	490	65	22
3	884	720	79	9
4	840	710	90	4
5	800	710	103	0
6	830	530	100	24
Average	803	635	89	9

the lower E.C.I. When the patients receive later on between 103 and 130 cal/kg/day there is a progressive improvement during treatment. If the metabolic machinery of the marasmic infant is subjected to "pressure" by giving a higher calorie intake, this low E.C.I. improves from the first days of treatment. Therefore, infants with severe marasmus on a high calorie intake do not show a lag in their weight curve. In order to effect a rapid increase in weight in these infants it is necessary to administer larger amounts of calories than those needed by normal infants. This fact is of considerable practical interest because of the tendency of pediatricians to be too cautious in feeding these infants.

It is hard to explain why an infant with severe marasmic malnutrition does not show a satisfactory increase when receiving a calorie intake which is adequate for a normal infant. This may be the consequence of several factors: (*a*) from a metabolic point of view, each unit of weight of a normal infant is not comparable to a unit of weight of a marasmic infant. Therefore, "unit of weight" may be considered a poor parameter to describe calorie requirement in marasmics. However, this cannot be the only factor explaining the lower efficiency of the calorie intake, because the efficiency of the calorie intake improves gradually

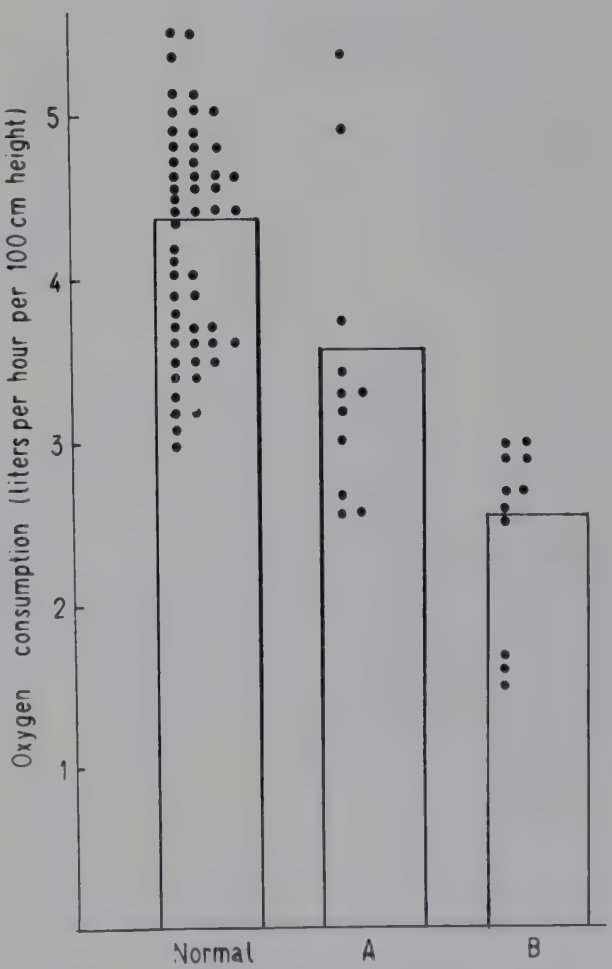

Fig. 1. Oxygen consumption expressed unit of height in 52 normal infants and 22 marasmic infants, A: during recovery and B: before improvement began.

TABLE 2. *Weight increase (g/day) with different calorie intakes in normal and marasmic infants.* Each determination corresponds to fifteen days of observations.

Cal/kg/day	105–130	131–155	156–180
Normal infants	25±6 (10 determinations)	26±9 (12 determinations)	—
Marasmic infants	14±7 (28 determinations)	25±10 (23 determinations)	30±10 (29 determinations)

with time, even though the calorie intake is maintained at a rather low level (Fig. 2). (*b*) There are many metabolic changes in the energy metabolism in marasmus: the rate of glucose degradation is decreased (12) and the general metabolic activity as measured by thyroid and pituitary activities is also diminished (6, 13, 14). This improves when weight increases and it is coincident with an improvement of the E.C.I. (*c*) Another possible explanation for this lower efficiency of calorie intake is that long-lasting malnutrition produces changes in the intestinal absorption of the calories

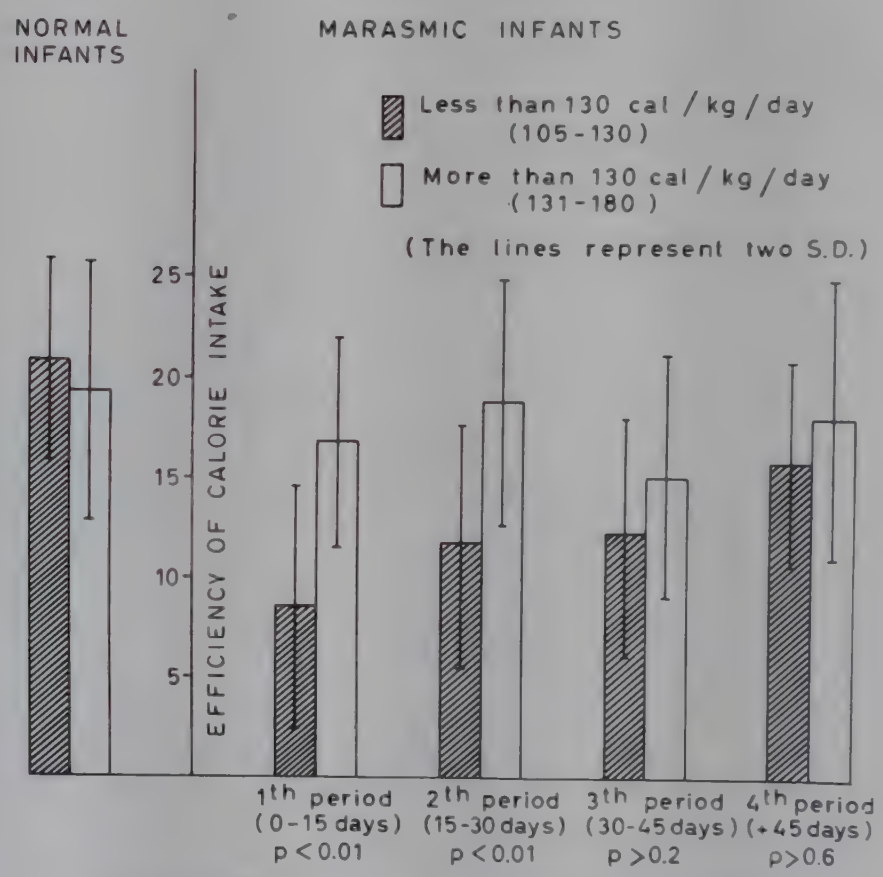

Fig. 2. Efficiency of calorie utilization calculated as:

$$\frac{\Delta \text{ weight (g) per day}}{\text{cal/kg/daw}} \times 100$$

in 22 marasmic infants and 10 normal infants. The first days after admission at the hospital. The second, third and fourth are successive periods. Infants were divided into two groups according to the number of calories received.

TABLE 3. *Chylomicronemia in 10 normal and 10 marasmic infants receiving 20 g of butter fat, before and after oral lipase.*

Blood sample (hours) after receive butter fat.	Chylomicronemia		
	Normal	Marasmic before lipase	Marasmic after lipase
0	0.2±1.6	2.3±1.3	4.7±3
		$p<0.01$	
2	14.1±5.6	8.6±3.9	13.2±5.9
		$p<0.01$	
4	15.4±5.6	11.2±3.8	17.2±5.3
		$p<0.01$	
6	7.0±2.7	3.6±1.9	9.1±6.0
		$p<0.01$	

administered. In this respect, it has been shown that both in marasmus and in kwashiorkor there is a lower absorption of fat (15, 16, 17, 18) and a lower disaccharidase activity (19, 23) together with histological alterations in the jejunal mucose (24, 28). We shall analyse with more details the absorption of fat and carbohydrates.

Fat absorption

The decrease in the absorption of fats which has been described in the undernourished infant may be caused by various factors. Thus, for instance, a decrease in the enzymatic activity of the duodenal liquid in the kwashiorkor patients as well as in marasmus patients has been described (29, 32). In both types of patients (15, 17) the oral administration of lipase improves the absorption of fats (Table 3). It is also possible that the absorption of fatty acids by the intestinal epithelial cells may be altered. As a rule the long chain fatty acids enter the intestinal cells where they are re-esterified and combine with lipoproteins to form chylomicrons, which pass to the blood via the lymphatic system (33). The administration of Puromycin which apparently blocks the protein synthesis at level of the intestinal epithelium produces steatorrhea because it inhibits the synthesis of the chylomicron's protein (34). In experimental animals, protein deprivation decreases the rates of RNA synthesis in several organs, including the intestinal mucosa (35, 38).

In the liver cells of kwashiorkor patients the synthesis of lipoproteins is blocked as a consequence of a decrease in protein synthesis (39, 40), resulting in fatty liver. A similar mechanism could explain the steatorrhea in infants with protein malnutrition. Based on these data we can assume that triglycerides with short or medium-chain fatty acids (10 carbon atoms or less) should be useful in the treatment of severe malnourished infants, because these fatty acids enter the mucosal cells without prior hydrolysis and are then transported in unesterified form via the portal blood (30). Lymphatic transport is not required. As far as we know there is no experience with short-chain fatty acids on the treatment of malnourished infants.

Carbohydrate absorption

It has been described how patients with kwashiorkor exhibit intolerance to lactose (20). Upon the administration of lactose of infants with chronic malnutrition no elevation of the glycemia is produced and the presence of lactose can be detected in the stools (21). The direct determination of dissaccharidase in the jejunal biopsy provides objective evidence of a significant defciit of lactase activity (Table 4) especially in infants with marasmic malnutrition (23). The same results have been described by other authors in patients with kwashiorkor (19, 22, 41). This alteration may explain the high frequency of diarrhoea during the

TABLE 4. *Lactose and sucrase dissaccharidase activities (μ/g of mucosa) in small bowel mucosa in normal, marasmic and marasmic-kwashiorkor patients.*

	Normals	Marasmics	Marasmic-kwashiorkor
Lactase	2.11	1.02	0.48
	1.35	0.40	1.14
	1.66	0.45	0.67
	1.35	0.50	1.10
		0.88	
Sucrase	1.8	3.8	2.7
	6.4	4.5	4.0
	2.1	4.4	2.3
	4.4	3.3	0.5
		1.6	

treatment of infants with severe malnutrition; when dissaccharides are not hydrolysed and absorbed, their presence in the intestinal lumen exerts an osmotic effect that leads to passage of frequent, loose acid stools. In the case of lactase deficiency the presence of lactose in the ileocecal region leads to fermentation of the carbohydrate by intestinal bacteria, resulting in the production of carbon dioxide and lactic acid. These products of bacterial activity exert an irritative effect in the colon, further aggravating the diarrhoea and being responsible for the acid pH of the stools (42). Good results have been reported during the treatment of infants with kwashiorkor when the disaccharides are replaced by monosaccharides in the diet (22). In our experience in infants with severe marasmus the replacement of the lactose decreases considerably the number and the frequency of the loose stools often observed during the treatment (43). Based on these experiences it seems advisable to decrease or eliminate the intake of lactose during the initial phases of the treatment of the severe malnutrition since the diarrhoea is the complication that most frequently conditions the high mortality of malnourished infants.

Protein needs

The absorption of nitrogen during severe malnutrition is apparently not affected (4). Even from the first week of treatment the percentage of absorbed nitrogen is normal (Table 1). However, in animal studies, it has been described that the rat submitted to low protein diets show a decrease in the activity of some dipeptidases (44). Nevertheless this decrease does not seem to be of major importance since it may just be an adaptive response because these parameters become normal as soon as protein is added to the diet of the animals.

A point of interest is the amount of protein that should be provided in the diet during the treatment of severe malnutrition. Different authors recommend different amounts. Experiences in Jamaica (45) and Perú (46) suggest that 2 g/kg/day of milk protein is enough. In Uganda, children with kwashiorkor are usually given 4 g/kg/day of milk protein (47), and Dean has used up to 6 g/kg/day (48). It is difficult, with the available data, to reach to a final conclusion, regarding the amount of protein that must be administered. In our country we usually provide between 3 and 4 g of milk protein per kg per day. We do not see a clear advantage for the administration of higher quantities and, on the contrary, it has been suggested that it may be dangerous.

Other animal proteins seem to be as good as milk's: fish protein, when properly elaborated, is capable of producing normal growth in infants when administered as the only source of nitrogen (Table 5) (49). Some authors have not been very successful

TABLE 5. *Effect of different levels of FPC protein on the weight increase of 4 infants, ages 2–6 months, over a 60 day period.*

Protein intake	Calorie intake (kcal/kg/day)	Protein calories (%)	Weight increase (g/day)[a]
3.5[b]	145	10.6	28
3.0	130	9.3	30
2.5	130	7.4	26
2.0	130	6.2	13

[a] Calculated as an average over 15 days.
[b] Values obtained in earlier experiments on 12 infants, ages 2.5–5 months.

with fish protein (22, 50) probably due to the fact that the fish flour varies in its quality depending on the way it is processed during its production.

Disturbances of water and electrolyte metabolism

Diarrhoea is a very frequent complication of severe malnutrition. In marasmic malnutrition, and specially during the first year of age, it rapidly reaches the point where it produces serious alterations in the acid–base balance and severe dehydration. When this complication appears the mortality rate is very high. It is often observed that in spite of the administration of adequate amounts, water is not retained and it is eliminated by the kidney. Acidosis with hipo- or hypernatremia are easily produced. In our experience acute dehydration in well nourished infants has a 4% mortality while in marasmics it rises up to 34% (3).

Many homeostatic mechanisms are altered in the marasmic infant: the sodium retaining capacity is very poor (Fig. 3) (53), the adrenal function is decreased and becomes easily exhausted (53, 54). The tubular capacity to secrete hydrogen is also decreased (55) and, in addition, the capacity

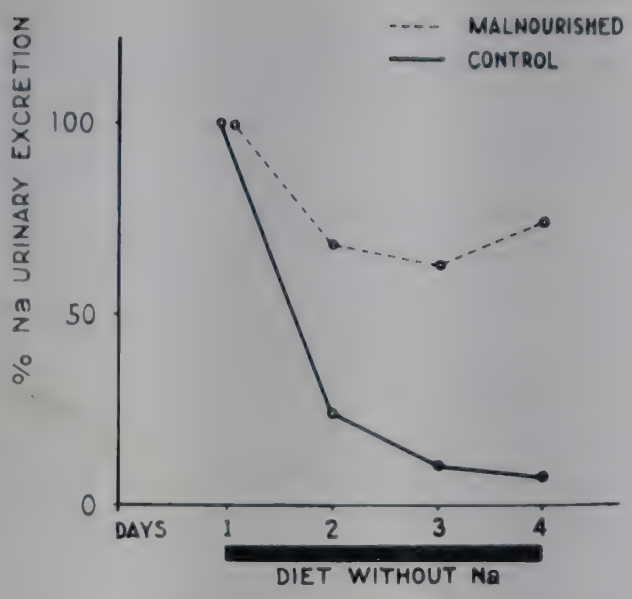

Fig. 3. Sodium urinary excretion before and after a diet without sodium in 10 malnourished infants and 6 normal infants.

to excrete a solute load is affected (56, 57). All these alterations explain the high risk that diarrhoea and dehydration mean for the infant with severe malnutrition. Our experience indicates that the most intense dehydration produced by diarrhoea appears in those infants with the most severe malnutrition (58) (Fig. 4) and also the most severe acidosis (Table 6).

Correction of the dehydration is con-

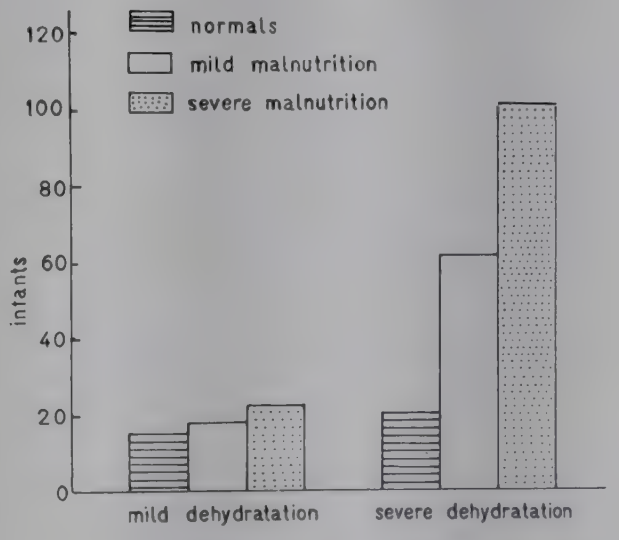

Fig. 4. Nutrition condition in 224 infants with acute dehydratation.

TABLE 6. *Relationship between pH and degree of malnutrition, in 262 infants with diarrhoea and dehydration, at the moment of admission in the hospital.*

Percentage of weight for age deficit	Blood pH			
	+7.30	7.29–7.19	7.19–7.10	−7.10
−10	37	32	8	3
10–20	36	32	14	10
21–30	22	24	29	32
31–40	10	16	33	32
+40	0	6	16	23

sidered an essential aspect of treatment. If the intravenous route is necessary we utilize a solution which has no more than 60 mEq/l of sodium (3). Special attention should be given to the deficit of potassium which may sometimes reach up to 50% of the intracellular potassium as we have demonstrated in muscle biopsies. From the practical point of view it is necessary to know the magnitude of the potassium deficit in order to make an estimate of the amount to be administered. Unfortunately there exists no easy way that allows the physician to appraise this deficit, since the levels of potassium in the plasma do not correlate with the deficiency of intracellular potassium. However, in our experience the clinical symptoms seem to be useful since those patients with great muscular hypotonia, hyporeflexia and abdominal meteorism also presented with the greatest potassium deficits (Table 7) (3). Whatever the cause, the potassium loss should be replaced as soon as possible. We have determined that if a solution containing 16 mEq/l of potassium is used intravenously, no hyperpotasemia is produced, in spite of the child being dehydrated (3).

Treatment of infection

The relation between malnutrition and infection has been extensively studied. Infec-

TABLE 7. *Potassium in muscle biopsy.*

Relation to plasma potassium, red blood cell potassium, electrocardiogram and clinical symptoms of potassium deficit.

	% decrease muscle K	% decrease K plasma	% decrease K R.B.C.	E.C.G.	Clinical symptoms
P. F.	64	0	18	N	+++
M. Z.	62	+20	22	N	+++
M. P.	62	25	38	N	++
J. M.	53	50	25	N	+++
A. G.	45	25	13	d.m.d.[a]	+
R. T.	42	50	11	N	+++
J. C.	39	20	+16	N	+
J. C. P.	37	20	16	N	+
C. R.	33	+15	22	N	+
M. H.	25	25	21	N	+
M. S.	25	+10	16	d.m.d.[a]	++
S. C.	23	30	4	N	−
E. I.	23	10	27	N	−
J. L.	23	30	27	N	−
I. C.	2	35	18	N	+

[a] Diffuse miyocardial damage.

tion is frequently present on admission and many times is subclinic, without much symptomatology, and sometimes its only manifestation is a stationary curve of weight.

The antibiotic choice will naturally depend on the predominant organism found to be the cause of infection. In severe malnutrition, antibiotics must be used if an infection is suspected (urinary infection, otitis, etc).

To summarize, the treatment of severe malnutrition continues to be a complex problem, as is demonstrated by the high mortality rate especially severely malnourished infants less than one year old. Malnutrition affects practically every organ and system and there exist many unknown aspects which require much deeper study in order to reach to more precise knowledge of it. Undoubtedly our greatest effort must be directed to the prevention of malnutrition; unfortunately malnutrition is conditioned by many factors which are out of our control as pediatricians.

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Summary of Discussion

Rapporteur: Y. Hofvander

The discussion was opened by *Whitehead,* who pointed out the difference in advice concerning the refeeding of kwashiorkor children given by Viteri in his paper advocating a fairly cautious beginning and *Mönckeberg* who advised almost immediate commencement of a high protein and calorie diet. Professor Hansen of South Africa has also pointed out that in kwashiorkor there is a disturbance in the ability to metabolize certain amino acids and he has claimed that an amino acid intoxication can occur in certain severely malnourished children. The experience in Uganda is, however, in agreement with *Mönckeberg* that a child with kwashiorkor can be started on a high protein—high calorie diet immediately on admission. Trials carried out by the late Professor Dean on lower protein-containing diets have not had any beneficial effects. The rate of disappearance of oedema tended to be slower and the rate of increase of albumin appeared to be slower. *Whitehead* stressed that it is important not to be dogmatic and to assess the best method of treatment for the slightly differing types of malnutrition found in vari-

ous parts of the world. It is important to get as quick a cure as possible in view of the scarcity of hospital beds. The same may also apply in a relief operation when it is urgent to be able to continue outpatient treatment as soon as possible.

Mönckeberg stated that there is a problem with the high protein—high calorie diets used, namely the overload of lactose. It may therefore be necessary to utilize other sources of protein than milk or to decrease the lactose level in milk.

Viteri referred to experience in Central America and Mexico where it was found that the slower the disappearance of oedema, the less trouble with electrolytes. Children treated with 3 g protein/kg improve their protein mass faster than children given 2 g/kg on an equal calorie basis. Weight gain seems to be much more related to calorie intake than to protein intake, as also has been shown by the group in Jamaica.

Stapleton pointed out that milk is not an absolute essential. There are many parts of the world where milk is never going to be available in adequate quantities, and it is therefore of great importance to investigate whether indigenous sources of protein are satisfactory, such as fish protein, as mentioned by Mönckeberg. Each mother will be convinced that the food that cures her baby will also be good for the baby after discharge. In Indonesia, child health programs were dependent on the distribution of dried milk and when the milk "dried up" it was difficult to convince mothers to come for other measures like health education or immunization. It is therefore important to see that foreign assistance is given in such a form that the country can go on producing its own needs.

With reference to the large numbers of marasmic children in Mönckeberg's report *Aykroyd* asked where all these children came from and why they were marasmic. *Mönckeberg* gave a brief review of the situation in Chile. During the last few years there has been a very serious decline in breast feeding partly because the "sophistication" of mothers and partly because of the programs of free distribution of milk from the government. At the same time the environment has not improved, the sanitary conditions remain poor and the educational level of the mothers is very low. This has led to a general impairment of the nutritional level of infants. The preschool mortality rate is 2.5 per 1 000 but the infant mortality rate is as high as 90 per 1 000.

Annan emphasized that what ultimately decides whether a government will set up dairy factories and fish protein factories is the economy. Fish protein, for instance, in Peru is too expensive for the ordinary mothers and for many years to come we will have to depend on dairy products as they have been shown to be of relatively low cost, and will have to encourage dairy production.

Stroh made some remarks on the general problems of nutrition in famine relief. One of the difficulties is in spreading information even among nutrition specialists in relief actions and in obtaining basic knowledge. Also there is the question of organization of activities in terms of improvement of nutrition and famine relief, the question of operation and, finally, psychological problems in dealing with the political situation, which was stressed earlier by Mayer and others. Although events lately may have shown shortcomings in organization and operations, the main problem has proved to be lack of knowledge among the organizers and operators in relief operations about the basic nutritional problems. This would have to include knowledge of the production, storage, distribution, preparation and finally consumption of food; the "normal" level of these factors would have to be known and also the present disturbances, their causes and manifestations and, finally, the measures to be taken. A practical approach using the available knowledge and resources in the world today would obviously improve the organization and the operations. There may sometimes be a serious lack of suitable personnel, but in this connection Stroh quoted Kipling: somebody objected to choosing a certain man for a certain job, saying that using that man for that job would be the same as to cut wood with a razor—and the answer: "in principle I don't like to cut wood with a razor, but if I had to do it I would prefer the best quality of razor". So either one has to start cutting some wood or get a wood cutter!

NUTRITIONAL REHABILITATION UNDER EMERGENCY CONDITIONS

by J. M. Bengoa[1]

Etymologically, the term "disaster" should include only natural, i.e. physical catastrophies such as earthquakes, hurricanes, floods, etc. In fact, however, it may be used in a wider connotation to include social maladjustments such as wars, revolutions, etc.

It is difficult to find a satisfactory and entirely adequate definition of a disaster in the literature. Parrish et al. (1964) in their study on the epidemiology of disasters state that: "disasters may be defined arbitrarily as epidemics or accidents in which twenty-five or more people are seriously injured or killed". The League of Red Cross Societies (1960) defines a disaster as: "Any event or series of events due to which a great number of people are suddenly in distress and in need of food, clothes, shelter, medical and nursing care, advisory services and other help of the utmost urgency". In this definition, the accent is on the need for urgent assistance in terms of medical care, food, etc.

Beach (1967) refers to the term disaster as: "a relatively sudden and violent disruption of the social system of a community, caused by some external agent or event over which those involved have little or no control".

Based on these different definitions, it may be said that a disaster has a *quantitative* component (the number of involved people) and causes a sudden *disruption* in the social system which requires *prompt action*.

Contrary to what is generally believed, most of the adult population in the world have been involved in one or more disasters, exceptions being very rare. There are countries in which an average of two earthquakes per year have occurred within the past fifty years.

The writer has had experience of a series of disasters, in particular earthquakes, floods, droughts and civil wars or revolutions. In each of these disasters the situation prevailing has varied widely and it would be very difficult to attempt to categorize the type of action taken.

In general terms, it can be said that in most cases the existing situation is often better than is thought when viewed from the outside. The calm of the survivors is frequently impressive, although the emotional shock may sometimes be the cause of an apparent calm. However, panic is not a general rule, as is indicated by the work of Beach (1967). This author states that: "panic occurs under very special circumstances, namely: when a group perceives or believes that the danger is *increasing rapidly* and that the few remaining escape routes are being blocked or closed". This is not the case in most earthquakes, but may frequently be so in volcanic eruptions and floods.

In actual fact, human beings are highly resistant to disasters. Beach quotes a Swed-

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ish saying: "A person can stand three times more than he thought he could, five times more than his wife believed he could and ten times more than his mother imagined he could."

These introductory remarks are important since the management of food in times of disaster depends very much on the psychological state of the survivors, as their co-operation is essential for identification of the beneficiaries and the distribution of food. A great proportion of survivors are able to assist in searches, rescue work and emergency relief, and it is very rare to find a break-down of moral codes in natural disasters although this may be common in social disasters.

In the initial phase of a major disaster, the first thing that health authorities must do after assessment of the nature and magnitude of the disaster, is to estimate the probable duration of the ensuing food shortage or severe social disruption. Their subsequent action will be guided by this estimation.

In any disaster—natural or social—the repercussions may be considered in three categories according to the duration.

1. Disruption of Short Duration

Under this situation—usually very violent and dramatic—improvization and speed become the basis for action. To save lives and open routes or other means of communication with the outside world are the priorities. During this period, which may be of several days, food distribution based on sound nutritional needs can seldom be made. In the short term, foods of some psychological significance such as coffee, chocolate, tea, etc., may be more effective than foods which are highly nutritional; especially if these require long cooking. When homes have been destroyed or electrical and fuel distribution disrupted, the organization of an *ad hoc* kitchen is necessary. This is frequently of great importance, particularly in cold climates. Characteristically, the action taken during a violent disaster is uncoordinated and emotional, when the good will of volunteers plays a more important role than that played by the technicians. This facet is, in fact, part of the disaster cycle itself and, in spite of past experience and perhaps the existence of certain prior contingency plans, this first phase is always disorganized.

In disasters of short duration, the priorities with regard to age goups are not very important, but there are perhaps three groups of people who deserve special attention, namely: (*a*) artificially fed infants since even a short period without appropriate food and water may present great risk; (*b*) hospital patients, particularly those injured during the disaster, and (*c*) manual workers, who participated in the rescue of survivors and restoration of services, which is usually an exhaustive labour.

2. Disruption of Moderate Duration

This may arbitrarily be classified as being of moderate duration, when the total period of distress is of a few to several weeks.

In such disasters there is more time to initiate adequate organization of nutritional surveillance and a food distribution programme. In a previously well-nourished population, main attention should be paid to artificially fed infants and to children during the weaning period. In a previously malnourished population the situation is much more complicated, and in such a case, the following order of priorities for surveillance and food distribution is suggested:

(*a*) Artificially fed infants;
(*b*) Lactating women;
(*c*) Children in weaning process;
(*d*) Pregnant women;
(*e*) Pre-school and school children;
(*f*) Manual workers;
(*g*) Old people;
(*h*) The rest of the population.

It is realized that in some circumstances it is impossible to organize a food distribution programme following the above criteria and that a simpler approach is needed. Nevertheless, some order of priorities should be established, particularly if milk supplies are limited.

If, in disasters of short duration, the question of quality of food is of minor significance, in disasters of several weeks duration it may be of great importance, particularly in previously malnourished populations.

3. Disruption of Long Duration

In general, this category corresponds to famine due to crop failures, wars, etc. It is obviously the most serious disruption from the nutritional point of view.

The nutritional surveillance of the population is of paramount importance. The priorities for food distribution are similar to those described in the section on the disruption of moderate duration. Sometimes, however, foods donated by national or external aid are abundant, and in such cases a generous food distribution programme covering not only the individuals at risk, but the whole population through food distribution at the family level, is possible. But even under these favourable conditions, food distribution should be based upon the composition of the individual families.

However, in most cases, food is limited and when the assistance arrives on the spot there is already a great number of the population which is malnourished. Under these circumstances treatment and nutritional rehabilitation is a matter of great urgency. This should be accompanied by the social and economic rehabilitation (including agricultural) of the population affected by a disaster. The books of Masefield (1963, 1967) provide a good orientation on this subject. In nutritional rehabilitation the need for establishing criteria for the detection and classification of malnourished people and the organizational aspects of the programme should be considered.

Detection and classification of malnourished people

The methods to be used for the detection and classification of malnourished people will depend on the type of personnel available. When medical staff are available to undertake this task, the problem is easy to solve through clinical diagnosis. In other cases, it is possible to use the services of very well qualified professionals such as nurses, social auxiliaries and social workers. In these cases, an anthropometric measurement—weight-height-ratio—is probably the best method to be recommended (Jelliffe, 1966).

However, unfortunately, in most cases we have to find some even simpler methods. In a recent disaster, in view of the impossibility of detecting the numerous cases of malnutrition through clinical or weight–height parameters, we recommended the use of arm circumference measurements (Jelliffe and Jelliffe, 1969; Miller, 1970) as the only tool to detect and classify the malnourished children. An objective measurement, even roughly taken is preferable to purely subjective assessment by non-professionals.

Regardless of the method to be used, the

important thing is to devise some mechanism by means of which cases of malnutrition can be easily detected, and classified into three or four grades according to severity so that the action to be taken may be determined.

Organizational aspects of the programme

It has been suggested that the best guide to the feeding programme for the initial period of biological rehabilitation of a malnourished population is an estimate of intake of the preceding few days. If, in the case of adults, this is considered to have been of the order of 1 000–1 500 calories, it should be safe to increase the intake for rehabilitation by 50%. In the case of the patient whose condition and history suggest that his diet immediately preceding has been less than 1 000 calories daily, the first day's quota should be set at 1 000–1 500 calories divided into five or more feedings of a liquid highly digestible food (WHO, 1951).

A good orientation has also been given by Clements and Rogers (1967) who suggest that in the severely under-nourished, a proven time schedule is about one month re-feeding for every five per cent loss of weight. For example, with an estimated loss of 30% body-weight, refeeding to regain the lost weight should extend over 6 months. A satisfactory refeeding schedule for a man of average weight and height, who has lost 25% of body weight, who has mild oedema, and assuming that he will engage in light to moderate work as rapidly as returning strength will permit, is as follows:

Days 1–3	1 500 calories
Days 4–7	1 800 calories
Second week	2 000 calories
Third week	2 300 calories
Fourth week	2 600 calories
Fifth week	3 000 calories
Sixth week	3 300 calories

Other papers presented at this Symposium will give detailed information on the dietetic aspects of the treatment and nutritional rehabilitation of malnourished children, which there is no need to repeat here.

From the experience gained in some recent disasters, it can be said that the organization of biological rehabilitation of a malnourished population does not differ from the organizational aspects involved in nutritional rehabilitation of chronically malnourished populations under natural conditions.

The recent paper published by Aall (1970) follows practically the same approach as the rehabilitation of a malnourished population in developing countries as has been discussed elsewhere (Bengoa, 1967). Aall suggests that children classified as very malnourished should be referred to the treatment centres (clinical malnutrition feeding units) to receive several meals daily, the children classified as moderately malnourished receive daily rations and children classified as mildly malnourished receive weekly rations.

One question which it is also relevant to mention here is whether it is necessary to rehabilitate the malnourished population in hospitals or whether other means are possible. It is our experience that the number of cases which necessitates hospitalization to achieve nutritional rehabilitation is relatively very small and that hospitalization is only required for a very short time. Most of the malnourished population can easily be biologically recuperated through feeding centres or nutritional rehabilitation units in which the patients receive several meals per day, but spend the night at home. This

will considerably reduce the cost of the programme, and the beds in the hospitals may be better utilized for treating very sick persons who require more constant medical supervision.

References to the results achieved in nutritional rehabilitation in times of disaster are very scanty (Lowenstein, 1962; Hall, 1970) and the information given is very limited. It would obviously be useful for the medical professionals involved in disasters to try to collect and publish data on the results obtained. But it is true that on many occasions it is an impossible task because the people involved in the assistance are, rightly, mainly concerned with the day-to-day problems, with very little time to accomplish other more long-term objectives.

Theoretically, the nutritional rehabilitation of malnourished populations in times of disaster should be easier to obtain than in the case of a chronically malnourished population, provided that the necessary foods are available. For instance, Gans (1969), during his recent work with a relief team in Queen Elizabeth hospital, Umuahia, Nigeria, found a surprisingly low mortality of 5.5% in cases of kwashiorkor. However, in developing countries, the acute or semi-acute famine due to a disaster is superimposed on the already chronically malnourished populations and this obvious fact complicates the problems. The following criteria for evaluation of the programmes directed to treatment and nutritional rehabilitation of malnourished populations in times of disaster may be considered.

1. *Mortality* (*fatality rate*)

Under natural conditions in developing countries the fatality rate of PCM (protein-calorie malnutrition) is still very high. In a recent revision of the literature (Bengoa, 1970) the mortality rates were found to be of the order of 30–40%. In fact, no advance has been made in the last 10 or 20 years.

In periods of famine the situation will probably be the same, although data provided by Lowenstein (1962) on the epidemics of kwashiorkor in the Congo in 1960 are of the order of 9–15%.

2. *Speed of recovery*

No such information is available in times of disaster. However, under usual conditions in developing countries, the speed of recovery of malnourished children in nutritional rehabilitation centres is of 3–4 months. The achievement of a normal growth pattern may, however, take more or even in some cases be impossible (Nutrition Reviews, 1970).

3. *Number of relapses*

Under normal conditions in developing countries with treatment in hospital the proportion of relapses may be of the order of 25–50% In the nutritional rehabilitation centres in Guatemala the proportion of relapses in 1969 was of 8% (de Leon, 1970). The importance of an appropriate follow-up of the cases recorded at institutional level should again be emphasized.

4. *The cost*

In famines of long duration, the question of the cost of the programmes of treatment and nutritional rehabilitation is of paramount importance. Since there are several alternatives for dealing with a malnourished population a cost-benefit analysis should be included in the examination of the programmes. The treatment in hospitals is obviously the most expensive, and except for very severely malnourished people particularly with complications, there is no need to use the hospital beds. As already in-

dicated, in times of disasters beds in hospitals should be used for other emergency medical problems.

Summary

The repercussions of a disaster may be classified into three categories of disruption according to the duration:

(*a*) disruption of short duration, usually a few days, in which improvisation and speed form the basis for action;

(*b*) disruption of moderate duration, from a few to several weeks, in which some priorities have to be established in nutrition programmes; and

(*c*) disruption of long duration, which corresponds to famines with serious nutritional repercussions, and a clear necessity for the establishment of priorities.

It is suggested that in disruptions of moderate and long-term duration, the following order of priorities in food distribution should be established:

(*a*) Artificially fed infants;
(*b*) Lactating women;
(*c*) Children in the process of weaning;
(*d*) Pregnant women;
(*e*) Pre-school and school children;
(*f*) Manual workers;
(*g*) Old people;
(*h*) The rest of the population.

These priorities may be influenced by the nutritional status of the population before the disaster.

In cases of abundant food aid, the assistance should be made at family level for the entire population with a minimal need for priorities for individual groups.

Some guides are given on the physiological aspects of re-feeding severely malnourished populations.

Finally, it is suggested that even during the period of food restriction, there is a need for surveillance and treatment of malnutrition, making minimal use of hospital facilities.

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Rapporteur: Y. Hofvander

In the following discussion *Jelliffe* agreed with Bengoa in the concept that the hospital should play a rather limited role in the treatment of malnutrition, much more limited than we appreciate. To emphasize the point Jelliffe referred to a paper written by himself entitled "The hospital as a lethal factor" and to one by his colleague Dr Robert Cook: "The hospital is no place for malnourished children" in which the risks involved in hospitalization are pointed out—cross infections, psychological deprivation due to separation from the mother if she is not allowed to stay, and too little time for health and nutrition education by the staff. The whole question of whether even severely malnourished children should be admitted to the average hospital needs very much more investigation.

Berg emphasized the need for a systematic approach to planning, evaluation and rehabilitation.

In the Bihar effort, an attempt was made to devise a famine control system, which charted the food and water supplies and needs at any given time in given areas. For instance, it was recognised that if the water level dropped below a certain level one could expect that within 2 days or 2 weeks people would be on the move; this could be anticipated and plans drawn up accordingly. There was an attempt to measure promptly the mortality, the morbidity, unemployment, prices, the number of people who came to relief centres, the number of those who were involved in works, projects, food thefts, etc. All of these were good indicators of the severity of the problems and the effectiveness of relief efforts.

Mayer underlined the importance of setting up priorities when dealing with an emergency situation. One further group which was not mentioned by Dr Bengoa and which has to be taken care of one way or another, is the group engaged in relief, in medical care, and in the police service. In as much as you are going to ask for intense work from people who also have access to the food because they are transporting it and distributing it, rather than to have it disappear in all sorts of ways, it is much more useful to recognize that it is unrealistic to expect a lot of work from people who are hungry and not expect them to worry first about themselves and their own family. It must be much better to have a policy where you set rations midway between what people would do on their own and what they would do if they were on the same level as everybody else and hope then that it can be enforced. You should also expect a rapid and enormous increase in theft not only of food but in everything that can be sold for food. Enforcement of price control may be important not only during the famine but also to prevent the famine from going on artificially later. The temporary price increase may make it advantageous for the local merchants not to release stocks. One of the reasons why famine should be eliminated as a legitimate weapon of war is that famine is a weapon that, like biological warfare, is not only indiscriminate in its choice of victims but is, in fact, discriminate. It acts specifically on those in the population who are least involved in warfare. There are enough data to prove that in all warfare the armies have been reasonably well fed while a famine hits hard at the vulnerable groups.

Experience has also shown that particularly when you are dealing with nurses, medical students and young relief personnel you have to *make them eat,* otherwise your whole system disintegrates.

The establishment of priorities was further discussed by *Aall.* Reference had been made earlier to "old age people" and how little they were cared for in many situations. It is quite normal in a developing country to have about 50% of the population below 15 years, 40% between 15 and 45 years (the working population) and 10% above 45 years, i.e. "old age people". The figures from an industrialized country could be 25% below 15 years, 65% between 15 and 65 and 10% above 65 years, i.e. "old age people". In other words: in a developing country a working population of 40% have to take care of the remaining 60% of the population in addition to themselves, while in an industrialized country the additional burden of a working population of 65% is only the remaining 35%.

In the recent Nigerian/Biafran conflict, at one stage an attempt was made to establish food distribution priority categories, as the food was so scarce that if distributed to everybody the impact would be almost nil. (This was on the Biafran side.) The following distribution categories were suggested: (1) children $^1/_2$–5 years; (2) lactating and pregnant women; (3) children 5–10 years, and nothing for the rest of the population. The reaction from some of the men was: "Stop all this rubbish, it is we men who shall have the food, let the children die, we will make new children after the war." The relief personnel from outside confronted with this were understandably deeply shocked, but the priorities suggested had to be modified. It is not only that the cultural pattern in many of the developing countries is different from those in industrialized countries, but with a different population structure due to the age distribution just mentioned, a severe famine situation becomes even more a question of survival than otherwise. If the numerically small working population does not take care of itself, the rest also goes.

Mathiesen finally referred to Bengoa's statement that initially the actions taken during a violent disaster are uncoordinated and emotional and this first phase is always disorganized. Fortunately, however, this is not the case always, but too often! Why is it uncoordinated and disorganized? During the last 7–8 years the League of Red Cross Societies has been eagerly looking forward to aiding governments and non-governmental organizations in their disaster planning. If all governments had prepared plans and included in them all relevant institutions and organizations, governmental and non-governmental, then the government and the community would be prepared to meet a disaster. The relief work during the first 2–3 days when the most important issue is to save lives would be more effective and more lives saved.

FAMINE RELIEF

Introduction

by R. Passmore[1]

Widespread scarcity of food leading to famine may occur under three different circumstances, (1) after a natural disaster such as an earthquake, flood or hurricane, (2) as a result of a failure of crops and (3) as a consequence of war. Each of these poses different problems.

Natural Disaster

The natural disaster poses the least difficult problems. There is widespread sympathy both national and international with the victims, and goods and expert helpers become available faster than the transport necessary to carry them to the stricken area. Also the victims are well nourished or at least have not had their health undermined by a long period of privation. Food is indeed not the first priority. A man takes several weeks to die of starvation, but he may die of cold in a few hours, and, if the water supply is inadequate and dirty, epidemics of infectious disease can break out in a few days. The organization of emergency supplies of food is an administrative problem which presents many local difficulties, but the talents to solve them are usually available. In nearly all cases relief is provided effectively before real famine conditions set in.

Failure of the crops

In many parts of the world failure of crops due to an unusually low rainfall is an ever recurring hazard of agriculture. The disaster can be foreseen and plans made to mitigate its effects. Famine is a classic problem for those who rule India. The British paid much attention to it and in the nineteenth century produced elaborate Famine Codes. These were based on a *laissez-faire* theory of economics, the belief that charity was degrading to the recipient and a trust in the value of public works.

All of these views may now be questioned. Nevertheless the British codes for relief worked on the whole. The disasters which accompanied famines in India in the seventeenth and eighteenth centuries were not repeated in the nineteenth century. The Bengal disaster in 1943–1944 with its appalling number of deaths, variously estimated as from one to three million persons, was not due to a failure of the relief measures. These were effective quickly once they were put into operation. The cause of the disaster was an extraordinary failure of communication. The Government and people of the capital were unaware that anything abnormal was happening in the countryside, until tens of thousands of hungry persons drifted into Calcutta and caused inconvenience in the main shopping centres by dying on the pavements.

Probably the relative success of the British Famine Codes was due less to their intrinsic merit than to the energy and devotion of the British and Indian officials who operated them. Kipling's story "William the Conqueror" is one of the great works of English literature. It relates what a few men and women can achieve to relieve the suf-

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ferings of the wretched victims of famine under the most difficult circumstances.

In 1951 I wrote for the Lancet an historical survey of famine in India. Since then famine conditions have arisen often in many parts of the country, but there have been no major disasters. Dr Ramalingaswami has told us how the Indian government of today has dealt with this old problem under contemporary conditions.

Emergencies due to crop failure also occur in Africa, but generally on a less disastrous scale than in India.

War

War and famine have gone together since human history began. Wars and particularly nationalist wars have been the important cause of famine conditions arising in the last two decades. Regretably but understandably, to try to starve the enemy out is an accepted mode of warfare. It is not a precise weapon because hunger and privation affect young children and old people much more seriously than the young adults from the armed services. A policy of starvation is likely to be more effective in causing suffering and distress amongst the civilian population of the enemy than in impairing their military effort. War is a peculiarly human attribute, closely associated with civilization. However, some efforts, not altogether unsuccessful, have been made to mitigate its horrors. Article 6 of the First Geneva Convention in 1864 states that "sick and wounded soldiers will be collected and cared for irrespective of nationality". That this article has been put in operation effectively in many wars is a magnificent achievement of the Red Cross. Could it be extended to include "starving civilians?" Could any international code be drawn up to help the victims of famine in war?

The drafting of any article in a convention requiring international agreement is beset with difficulties. The words used must be clear and not capable of misinterpretation. An immediate problem is that there is as yet no definition of "famine" that is precise and accurate enough for purposes of international politics and administration. Even when a satisfactory draft has been prepared, it has to be accepted by governments to many of whom the idea would be novel and at first sight appear impractical. However the members of the 1864 Geneva Convention must have faced similar difficulties. Every new venture must have a start and the following sentence is put forward for discussion, amendment and amplification.

"In any conflict the combatants must allow food sufficient to prevent famine to reach all civilians, irrespective of nationality."

The idea of a *laissez-passer* for international and other relief organisations who bring food to starving people will appeal to men of good will in every country.

STUDIES OF THE BIHAR FAMINE OF 1966–67

by V. Ramalingaswami, M. G. Deo, J. S. Guleria, K. K. Malhotra, S. K. Sood, Om Prakash and R. V. N. Sinha[1]

Genesis of the famine

The successive failures of the monsoon in 1965 and 1966 were the startling events that formed the background to the Bihar famine which affected predominantly the southern districts of the State. (Figs. 1 and 2.) The State of Bihar in the Indian Union had a population of 53 million persons in 1967. It is the second largest state in India from the point of view of the density of population. There are 694 persons per square mile which is double the average for the rest of India. Over 23% of the population belong the scheduled castes and tribes. In addition, there are several other socially and economically backward classes in the State. The State is predominantly rural; 90% of the population lives in the villages, and agriculture is the most important occupation of the people. There is an outdated and wasteful agrarian system of economy in the State. 75% of those that cultivate the land own only 1% of the land. 5% of the cultivators own 50% of the land. Over 80% of land holdings are below 5 acres in size. Nearly 30% of those who work on land have no land belonging to them at all; they are landless labourers. It was on this group of people that the burden of famine fell most heavily (Public Relations Department, 1967).

In Bihar, agriculture is dependent to a large extent upon rainfall. Only 7% of the gross sown area has assured irrigation. Richness or poverty thus depend upon the vagaries of Nature. The rivers of South Bihar run at great speed and empty rapidly. Even when the State receives normal rainfall, its annual production of 7.5 million tons of food grains is not enough to feed its people adequately. There is a 'normal' annual deficit of 1.3 million tons. The year 1965 was a bad year as the rains were deficient, but even as the State was recovering from this drought, a double tragedy had overtaken it by way of floods in North Bihar and failure of rains in South Bihar. It was this series of events that brought about a serious food situation by the end of 1966.

As a result, food grain production declined to less than 25% of the normal in large parts of South Bihar. The annual production in the State as a whole fell from 7.5 million tons to 3.5 million tons. The theoretically available food grain to the people fell from 13.4 ounces to 6.5 ounces per head. Out of 53 million people, 30 million people faced scarcity conditions and famine. 18.8 million cattle were also in a similar plight. There was very serious shortage of water (Singh, 1970; Verghese, 1967).

Rice forms the staple food of the people of South Bihar. Pulses and millet are normally added in small quantities. Roots and tubers, the flower of a wild tree *Mahua*, which is a predominantly carbohydrate

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Fig. 1. Map of India.

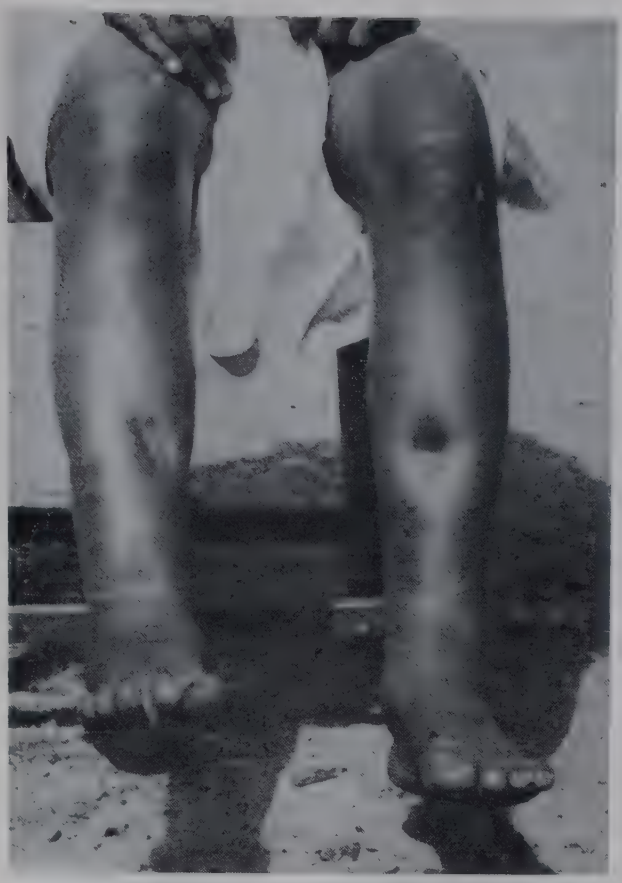

Fig. 3. Pitting oedema on the lower extremities in a patient of hunger oedema.

Fig. 2. Map of Bihar showing the area of study in the famine affected district of Hazaribagh.

source and mangoes in season add substantially to the caloric intake. As the availability of cereal grains fell, the intake of roots and tubers increased. Wild leaves were consumed in increasing quantities, *mahua* consumption increased. Diet surveys conducted by the State Department of Nutrition at intervals of time in various parts of South Bihar between 1966 and 1967 showed that in several regions the caloric intake dropped from 2 200 per capita per day to nearly 1 200 calories. Likewise, protein intakes fell from 74 g to 31 g and there was a variable fall in the intake of other nutrients as well. About 20 % of the families surveyed in 1967 had a caloric intake of 1 000 calories or less per capita per day (Swaminathan et al., 1969). It is obvious that a steep fall in the consumption of food had taken place between 1966 and 1967. The people most affected were the

Fig. 4. A severely marasmic child.

Fig. 5. A marasmic child showing marked wasting.

landless labourers and those who had small land holdings. Protein-calorie malnutrition both in children and adults appeared on a large scale (Figs. 3, 4 and 5).

The phenomenology of the famine

As the drought changes into scarcity and scarcity into famine between the latter part of 1966 and the early part of 1967, a series of events took place on the South Bihar scene. Prices began to rise, thefts increased, the social structure began to crumble, hooliganism and indiscipline were on the increase. The scarcity of food was so great that people gathered around railway sidings and grain chutes in order to collect individual pieces of grain from the dust. Those who were relatively fit migrated to adjoining industrial areas leaving behind the aged, the infirm and the sick. In one district alone, 40 000 people left the district in search of food and job. The agrarian structure was greatly disturbed. Sale of land was on the increase, the sale of cattle also increased. One could buy a cow for less than Rs.10. Even the seed that the farmers stored for the next sowing season was consumed. Beggars increased in numbers, mortgage of land was in evidence. The scarcity of water was most acute. There was a cry for water everywhere. A general state of alarm existed. Starvation deaths in thousands were predicted around the corner. There was a pathetic submission to deprivation. The village drums and music died out. People became sullen and listless. Each day that passed, one felt relieved by the time of dusk that one more day in this long long famine had gone by. The splen-

did wild life of South Bihar faced extinction. As the hill streams dried up, tigers and panthers frequented the remaining water holes. The fast-vanishing Indian gazelle showed up at water points in full view of people. One could see as one drove through this vast expanse of South Bihar an unending stretch of parched and dry fields. In the midst of this, Bihar went through a general election along with the rest of the country as the democratic processes had to be renewed and there was a hope that they might provide an answer in the long run. A long and losing battle was forecast. But as it turned out eventually, the tragedy was overcome (Singh, 1970).

Relief operations

The most massive and stupendous relief operation ever known in history was mounted. In this there was participation by the State and Central Governments, by private agencies, by foreign Governments, United Nations agencies, religious groups, individuals and students. The combined activities of all these groups prevented a major catastrophe. The measures that were taken were briefly the following.

There was a realization that the whole strategy of operations must be flexible and adaptable to a constantly changing situation. The relief operations were also characterized by close co-ordination between voluntary and Government agencies. There was de-centralization of decision making to the lower echelons at the point of action. Novel methods of working were tried out. Water was as important as food and from the very beginning every effort was made to raise the water resources of the area so as to provide at least two gallons of water per head per day. In any operation of this large size, transportation plays a crucial role. The ships that arrived at the ports in India carrying food grains had to be emptied and the food grains carried to the remote rural areas of South Bihar expeditiously. Railways, road transport, water transport and bullock carts were employed. Nine million tons of imported food grains and 4 million tons of local grain were moved into the famine areas. 150 000 ration shops were opened. The village schools provided the focal points for the free feeding of children and expectant and nursing mothers. While education might have suffered during this period, the involvement of the village school as a community feeding centre proved to be a highly successful operation. In this manner, 6 million children including both school and preschool age and expectant and nursing mothers were given one free meal a day at these schools. 25 000 schools were involved in this kind of operation. Free communal kitchens were organized and these were feeding nearly half a million people. Some 0.8 million people were provided with work on the basis of which they were given food. A number of other devices were used to increase the purchasing power of people through the use of manual labour. A massive operation for increasing the resources for agriculture was mounted. Efforts were made to save existing crops to the extent possible and to raise short-term emergency crops. Loans were given for cultivation. There were instances when people applied for loans to celebrate marriages of their daughters even in the midst of this grim tragedy. Provision of pumps and Persian wheels, construction of roads and embankments, digging superficial and deep wells, installation of boring machinery, hand-operated and sophisticated rigs were some of the operations mounted for increasing the resources for agriculture. It has been

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said that more has been done in the matter of digging of wells, building of tank bunds, deepening of existing wells and electrification of villages in the last 6 months than in the preceding 20 years. The famine was contained and Bihar saved, by the timely, unprecedented way in which men, materials and money had poured in and were organized into a cohesive and massive relief operation. Health care programmes were initiated consisting of vaccinations against cholera and smallpox, periodical disinfection of wells, tanks and other water sources and provision of static and mobile medical teams to take care of sick people. The thousands of starvation deaths that were forecast had not taken place. Major epidemics did not occur, and on the whole, the health of expectant and nursing mothers and of the children was better than before the famine (Singh, 1970).

Health conditions

There were many ways of measuring the impact of famine on the health status of people. Anthropometric measurements such as body weight, height and arm circumference are useful, particularly if some data are available with regard to the pre-famine status of the population. The appearance of protein calorie malnutrition in infants and children, its frequency and severity, would be another yardstick especially if the information can be compared with the pre-famine situation. Hunger oedema appearing in adults is a dramatic manifestation of famine and could be used as one of the yardsticks of the severity of the famine. Deaths from famine are yet another yardstick but it is often difficult to attribute deaths directly and specifically to famine since associated infections often complicate the picture.

A team of workers from the All India Institute of Medical Sciences drawn from several disciplines went to South Bihar to study the health conditions of the famine affected victims in May/June of 1967 and in particular to make a study of hunger oedema in adults. The study was made for a period of 5 weeks. By the time our studies began, the tide had already turned. There were signs that the famine had been contained although there was still some distress in outlying areas. There were still many imponderables. Will the monsoon come as scheduled in 1967? How will it disrupt the relief operations and the communications system set up to fight the famine? What would be the incidence of water-borne diseases? Will epidemics occur? How will the impoverished cattle and men work again in the fields? The famine might have been contained but the fears remained.

We first made a rapid impressionistic survey of the health status of people in randomly chosen villages in the district of Hazaribagh in South Bihar (Fig. 2). This district has an area of 7 016 square miles and is predominantly a forest district. Over 90% of the population lives in villages and agriculture is the main occupation. A total of 40 villages distributed in three Community Development Blocks, Pratappur, Chatra and Simaria, were surveyed involving a population of 6 000 people. The overall prevalence of protein calorie malnutrition in the form of marasmus, kwashiorkor and intermediate grades in infants and children, and hunger oedema in adults was of the order of 5% of the total population. There was considerable variation from village to village. Wide discrepancies were noted in the frequency of protein calorie malnutrition even in neighbouring villages. The existence of a single deep bore well made a difference to the nutritional status

of a cluster of people living around it and on the connected fields.

Studies of hunger oedema in adults

Clinical Studies

Out of the large number of adults above the age of 20 who showed varying degrees of oedema, 49 were admitted into the district hospital in Hazaribagh for detailed investigations. They were selected from a larger number of patients and were free from cardiovascular, renal or hepatic diseases and did not have active pulmonary tuberculosis. Their age and sex distribution are shown in Table 1. The ratio of persons in different age groups and between males and females in this group does not necessarily reflect the pattern of hunger oedema in the community in view of the high degree of selectivity of admissions. However, the finding that a majority of cases of hunger oedema were in persons in the older age groups is corroborated by the results of our impressionistic surveys in the community. The brunt of the famine fell on infants and preschool children and on the elderly. There were many young adults who were seen out in the field who also had mild oedema but continued to work and earn their livelihood to some extent.

All the patients admitted belonged to the lowest socio-economic status. They had hardly any clothes on them; only 4 out of 49 owned a small piece of land while the remainder were working as labourers on lands owned by others. The living habits and social customs were primitive. Of the 49 patients, all except three were married. The females were extensively covered with tattoo marks considered to be beautification marks in married women. A majority of the patients gave a history of very poor intake of nutrients immediately preceding the onset of oedema. Their diet during the past few weeks consisted predominantly of *Milo, Mahua* and wild leafy vegetables. The clinical features presented by this group of 49 patients with hunger oedema are given in Table 2.

Oedema was the main presenting feature. It started first over the feet and gradually spread upwards. The onset was insidious. In 8 patients, the appearance of oedema was

Table 1. *Age distribution.*

Age group	Male	Female	Total
20–29	4	3	7
30–39	7	5	12
40–49	6	3	9
50–59	13	3	16
60–69	5	0	5
Total	35	14	49

Table 2. *Clinical picture.*

Clinical Features	No. of Patients
Oedema	
Mild	8
Moderate	23
Severe	18
Ascites	
Mild	3
Moderate	16
Severe	22
Anaemia all grades	49
Wasting of muscles	35
Night blindness	1
Paraesthesia	6
Exertional dyspnoea	13
Urinary complaints	
Polyuria	1
Oliguria	1
Evidence of other deficiencies	1
Evidence of congestive heart failure	0
Neurological deficit	0
Skin lesion (toad skin)	1

precipitated by an attack of diarrhoea. In 5 very advanced cases, the oedema was so massive that fluid was oozing out from the body through cracks in the skin over the feet and ankles.

The oedema was classified as mild, moderate and severe depending upon whether it was confined to the feet and legs only (mild) or had involved, in addition, the genitalia and the face (moderate) or extended further to the abdominal wall and hands (severe). One half of the patients had become oedematous during the past month. The longest duration of the oedema was 6 months; the majority had the oedema for 1 to 2 months. The swelling of the body was a dramatic feature and it was only when this became grossly manifest, that the patients began to think that there was something wrong with them. The swelling first appeared over the feet and ankles and in the early stages became manifest only towards the end of a day's labour. At the time of admission to the hospital, a majority had moderate to severe oedema. It is of particular interest that a majority of patients with oedema also had moderate to severe ascites, a feature characteristic of hunger oedema. There was gross wasting of muscles but no neurological deficits.

Laboratory studies

The laboratory investigations included determination of haemoglobin (cyanmethaemoglobin method); micro-haematocrit; total erythrocyte count; examination of peripheral blood and bone marrow smears stained with Romanowsky stains and for haemosiderin by Perl's reaction; routine chemical and microscopic study of urine; a microscopic examination of stool; determination of total serum proteins using the biuret technique and differential proteins by electrophoresis.

Blood volume was determined by using Chromium^{51}-labelled red cells. Patients' own red cells were used and the method of Mollison & Veall (1955) was employed. About 20–30 μCi of high specific activity $Na_2Cr^{51}O4$ obtained from the Atomic Energy Commission, Trombay, Bombay, was used and counts were obtained in a well type gamma scintillation counter of the Tracer Laboratory. Red cell mass calculated was on the basis of whole body haematocrit obtained by multiplying venous haematocrit by a factor of 0.91. No correction was made for trapped plasma. Plasma volume was calculated by deducting the red cell mass from the whole blood volume.

Total body water and sodium space were measured in 5 cases of hunger oedema using tritiated water and ^{24}Na respectively. The techniques used were essentially those described by Silver (1963). The isotopes were obtained from the Bhabha Atomic Research Centre, Bombay. The patients were given 1 μCi of tritiated water orally in the morning. Blood and urine samples were collected after 12 hours of the administration of the isotope by which time equilibrium was obtained. No fluids were given during this time interval. Tritium was measured in plasma and urine using Packard Liquid Scintillation Counter. For the purposes of the estimation of the extracellular fluid, each patient, after overnight fasting, was given 10 μCi of ^{24}Na as NaCl in 100 ml. of water. Urine was collected for the next 24 hours. The volume of the extracellular fluid (sodium space) was calculated using the formula—

$$\text{Extracellular fluid (litres)} = \frac{^{24}\text{Na injected} - ^{24}\text{Na excreted (in } \mu\text{Ci)}}{\text{Plasma } ^{24}\text{Na per litre (in } \mu\text{Ci)}}$$

The water load test was performed in 14 patients. After overnight fast each patient received orally 20 ml of water per kg of body weight. The volume of urine passed in the next 5 hours was measured.

Glomerular filtration rates were measured in 5 patients using insulin clearance test. The technique used was essentially that described by Weller (1966).

Two intestinal function tests, namely, absorption of vitamin B_{12} and D-xylose were performed. The absorption of the D-xylose was

studied in 18 patients using a 5 gm test dose. The total amount of D-xylose excreted in the urine in 5 hours following the oral administration of the dose was estimated using the method of Roe & Rice (1948). Absorption of vitamin B_{12} was measured using the Schilling test (Schilling, 1953). Each patient was administered, after a 12-hour overnight fast, 1 μCi of Co^{58} vitamin B_{12} (spec. act. 1 μCi = 1 μg). Two hours later, 1 000 μg of cold vitamin B_{12} was injected intra-muscularly as the flushing dose. 24-hour excretion of the labelled vitamin was measured by using Tracer Lab. Scintillation Counter.

Liver biopsies were performed by aspiration on 15 patients with hunger oedema, fixed in 10% buffered formalin and cut in paraffin blocks. They were stained routinely with haematoxylin and eosin and with periodic Acid Schiff. Five patients who died in hospital were autopsied and gross and microscopic studies carried out on the various organs in the usual manner.

The anaemia

Anaemia was universal. All patients were anaemic with haemoglobin levels of less than 12 gm%. Table 3 shows the composite blood picture in these patients. In 36% cases anaemia was quite severe with haemoglobin less than 8 gm%. The total red cell mass (Table 5) and total circulating haemoglobin were markedly reduced. The haematocrit values followed the haemoglobin pattern. With the exception of two adults, all had a haematocrit less than 36%. The mean corpuscular haemoglobin concentration was also low in a majority of the patients and hypochromia was common in the peripheral blood film. None of the 44 bone marrows examined showed adequate amounts of stainable haemosiderin. The morphological picture of the marrow was suggestive of deficiency of both iron and vitamin B_{12} and folic acid. A majority of these patients had received multivitamin pills containing variable amounts of vitamin B_{12} and folic acid before admission to the hospital. Marrows therefore, were in a stage of reactive transition from megaloblastic to a normoblastic morphology. However, in 5 cases, frank megaloblastosis was still present. Macropolycytes and giant metamylocytes were encountered in over 50% of the cases. In the 12 children of marasmus and kwashiorkor the haemoglobin levels ranged between 4.6 to 11.6% with an average of 8.6%. The pattern of anaemia was similar to that observed in adult pattern (Table 3). In a nearby village with a total population of about 400, 53 adults were randomly picked up. Their mean haemoglobin was 10.5% with range of 6.9–13.7%, 87% of these were anaemic with haemoglobin less than 12%.

Cardiovascular status

It was of interest that in spite of such severe anaemia, these patients showed no clinical evidence of hyperkinetic circulation seen in cases of pure anaemia. The pulse rate ranged from 48 to 100, with an average of 76 per minute (Table 4). The blood pressure ranged from 85 to 160 mmHg systolic and 45 to 90 mmHg diastolic, the average systolic and diastolic pressures being 112 and 74 mmHg respectively. The pulse pressure ranged from 20 to 70 mmHg, the average being 38 mmHg. No clinical evidence of cardiomegaly or congestive heart failure was present in any of the cases. The cardio-thoracic ratio estimated from straight X-ray skiagrams of the chest ranged from 30 to 54% with an average of 43.6%. The absence of expected hyperkinetic circulation and its effect on the heart may be due to a decrease in the

TABLE 3. *Haematological data in adults with hunger oedema, malnourished children and apparently healthy rural subjects.*

	Hb (g %)	Hct (%)	Red cells (X 10^6/mm^3)	MCV μ	MCH (pg)	MCHC (%)
Adult (44)						
Mean	8.2	28	3.12	91.4	26.7	29
Range	3.6–11.9	12–41	1.22–4.50	70–117	17.6–38.7	24.3–38.7
Children (12)						
Mean	8.6	29.4	3.49	78.6	25.5	29
Range	4.6–11.6	16–37	1.73–4.30	73–106	20.6–30.6	25.1–31.7
Rural subjects (53)						
Mean	10.5	30.8				
Range	6.9–13.7	21–41				

Figures in parentheses denote the number of persons.

TABLE 4. *Cardiovascular assessment.*

	Mean	Ranges
Pulse (per min)	76	48–100
Blood pressure (mmHg)		
Systolic	112	85–160
Diastolic	74	45–90
Pulse pressure (mmHg)	38	20–70
Cardio thoracic ratio (%)	43.6	30–54
E.C.G.	Nothing significant	

metabolic rate as a result of protein-calorie deficiency.

As stated earlier, signs of vitamin and mineral deficiencies were clinically very infrequent. Only one patient gave a history of night blindness. It was obvious that these patients with hunger oedema did not suffer at the time of oedema from multiple vitamin deficiency. The major problems were protein-calorie malnutrition and anaemia.

BODY COMPOSITION

Table 6 shows the results of serum protein estimations. It will be seen that the serum albumin levels in patients with hunger oedema are abnormally low, the average being 1.5%. The table also shows results of serum protein estimations in some chil-

TABLE 5. *Blood volume in 27 adults with hunger oedema.*

	Body weights (kg)	Whole blood volume		Red cell mass (ml/kg)	Plasma volume (ml/kg)
		Total (ml)	ml/kg		
Patients					
Mean	42.5	2 727	64	15.5	48.2
Range	31–62.5	1 731–4 347	45.1–90.5	10.7–22.7	34.2–68.3
S.D.			±3.40	±3.67	±3.04
Normal[a]					
Mean			61.8	31.8	43.3
S.D.			±5.6	±3.50	±5.97

[a] From Silver (1963).

TABLE 6. *Serum proteins in adults with hunger oedema, malnourished children and apparently healthy rural subjects (g per 100 ml serum).*

	Total protein	Albumin	Globulin
Adults (32)			
Mean	5.6	1.50	4.27
Ranges	3.1–8.5	0.50–3.23	2.20–6.13
Children (10)			
Mean	6.03	2.65	3.28
Ranges	4.7–8.4	1.00–6.46	1.42–4.94
Rural subjects (32)			
Mean	5.79	2.21	3.58
Ranges	4.15–7.45	1.28–3.65	2.53–4.86

Figures in parentheses denote the number of persons.

dren with kwashiorkor and in the general population in a village where signs of protein-calorie malnutrition were not in evidence but the village was in the area where famine has occurred. From a consideration of these values, it would appear that patients with hunger oedema have very low levels of circulating serum albumin. It is also obvious that the famine occurred against a background state of chronic malnutrition as revealed by the low albumin values even in a village where there were no obvious signs of famine. Fig. 6 shows the body composition in patients with hunger oedema, 72% of the actual body weight consisted of water, revealing the extreme state of hydration in these patients. 55% of the total body water was formed by extracellular water as indicated by the great expansion of sodium space. Blood volume was determined in 27 patients (Table 5). On the basis of actual body weights which averaged 42.5 kg in this group of patients, the absolute values of blood volume were low but when they are expressed as a percentage of the actual body weight, both the blood volume and the plasma volume were

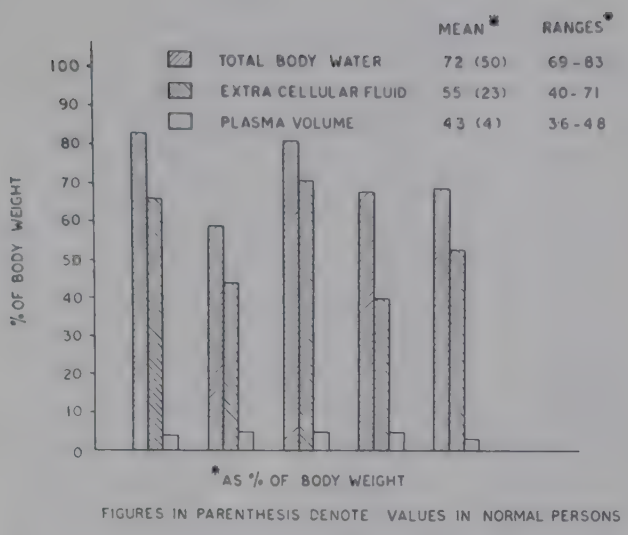
MEAN*
RANGES*
TOTAL BODY WATER 72 (50) 69-83
EXTRA CELLULAR FLUID 55 (23) 40-71
PLASMA VOLUME 43 (4) 36-48
% OF BODY WEIGHT
*AS % OF BODY WEIGHT
FIGURES IN PARENTHESIS DENOTE VALUES IN NORMAL PERSONS

Fig. 6. Body fluid compartments in hunger oedema.

either normal or above normal. The table also shows the extremely severe reduction of the total red cell mass which is a reflection of the anaemic state.

Fig. 7 shows the results of water load tests in a group of patients with hunger oedema. Most of them showed marked decrease in the excretion of water. Thus the mean excretion of water was 34.7% of administered dose as opposed to 70% in a group of normal subjects in this laboratory.

Table 7 gives the results of estimation

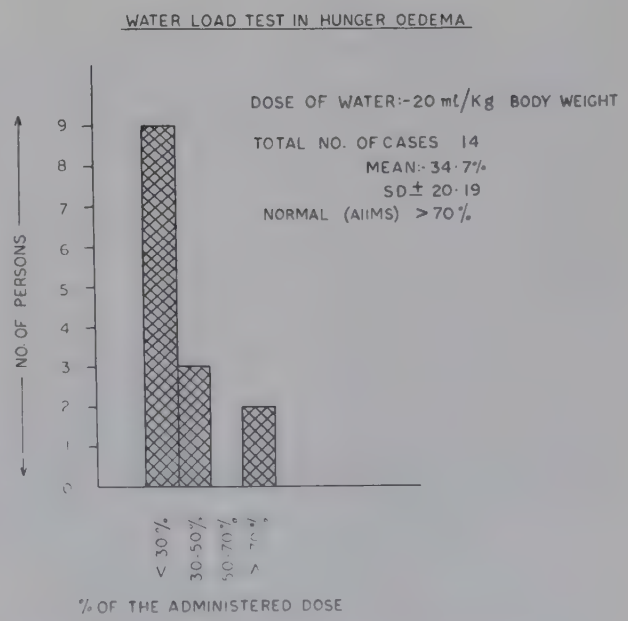

Fig. 7. Water load test in hunger oedema.

TABLE 7. *Glomerular filtration rate (gfr) in patients with hunger oedema.*

Patient	Body weight (kg)	GFR[a] ml/min
J. M.	41	84
M. B.	60	47
S. R.	42	86
K. G.	48	123
B. H.	48	77
Mean		83.4
Normal[b]		130 ±21.5

[a] Corrected to a surface area of 1.73 sq.m.
[b] Allen, A. C. (1962).

of glomerular filtration rates in a small group of 5 patients with hunger oedema. It will be seen that either the filtration rates are normal or are slightly depressed. The number of patients studied is small and there is a wide scatter.

ASSOCIATED DISEASES

Nearly 20% of patients with hunger oedema revealed evidence of active pulmonary tuberculosis clinically and radiologically. Those that showed tuberculous lesions were not included in the study. Study of the faeces of the patients admitted to the hospital and apparently normal rural subjects revealed a high infestation rate (Table 8).

In only about 3% of patients with hunger oedema was there no evidence of intestinal parasitic infestation. The vast majority harboured hookworms. Only a third of them harboured a single parasite in their intestines. 40% showed infestation with two parasites and a few showed evidence of infestation with three different parasites. The picture was broadly similar in a group of persons living in a village apparently unaffected by famine.

TABLE 8. *Parasitic infestation in hospital and rural subjects.*

	Hospital patients (33)		Rural subjects (33)	
Parasite	*n*	% of total	*n*	% of total
None	1	3.0	2	6.0
Hookworm	27	81.8	26	78.8
A. lumbricoides	6	18.1	11	33.3
S. stercoralis	3	9.1	—	—
E. histolytica	14	42.4	9	27.2
E. coli	6	18.1	5	15.1
H. nana	3	9.1	4	12.1
G. lamblia	6	18.1	5	15.1

Figures in parentheses denote the number of individuals studied. Most of the individuals showed multiple infestations.

AUTOPSIES

Autopsies were performed on 5 patients with hunger oedema who died in the hospital. They were performed within 1 to 2 hours after death. Massive oedema was the characteristic feature and the body cavities were filled with fluid. Oedema was most severe in the lower limbs involving the feet, ankles and legs. There was oedema of the scrotum and penis and of the abdominal wall. The dorsum of the hands showed obvious pitting oedema and so did the face. In fact, there was oedema wherever there was loose connective tissue. On cutting into the oedematous tissue, a clear colourless fluid oozed out and the connective tissue appeared pale, shiny and gelatinous. The fluid in the body cavities was massive, that in the peritoneal cavity being maximal. Three to five litres of fluid could be readily removed from the peritoneal cavity. Unlike the connective tissue fluid, the ascitic fluid was faint yellow in colour but was equally clear and looked like a transudate. A further one to two litres of fluid

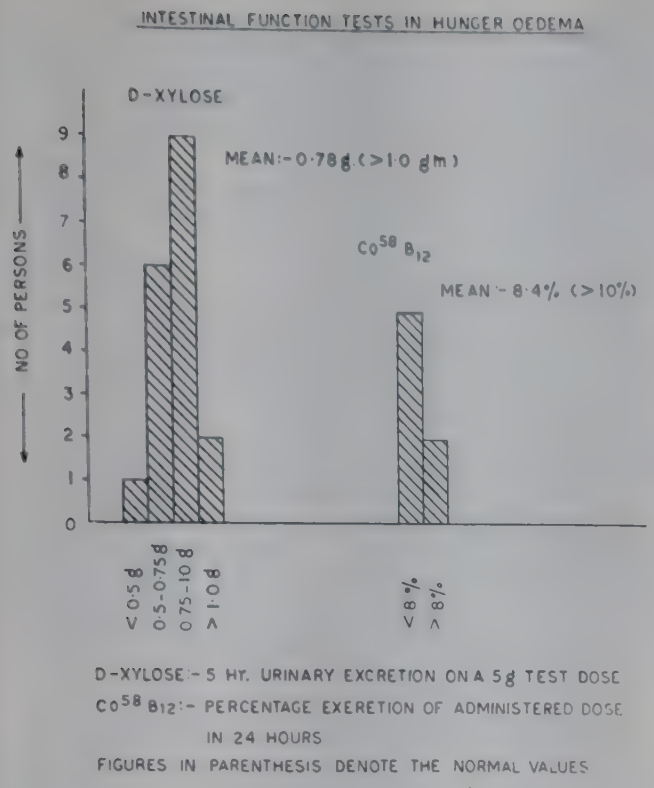

Fig. 8. Intestinal function tests in hunger oedema.

was found in the pleural and pericardial cavities, and there was fluid in the tunica vaginalis of the testis.

An equally striking feature was atrophy involving all the organs of the body to a greater or lesser extent. Skeletal muscle wherever present was markedly atrophic. There was practically no recognizable fat either in the subcutaneous areas, mesentry, omentum or in the perirenal area. There was no trace of sub-epicardial fat.

Fig. 8 gives the results of D-xylose and vitamin B_{12} absorption tests in patients with hunger oedema. There is a mild absorptive defect with respect to both these substances.

The gastrointestinal tract showed some mucosal atrophy but its integrity in general was surprisingly well preserved, suggesting that the absorptive defects if any would be of a mild nature and reversible. This was indeed so (Fig. 8). The upper part of the jejunum which was studied in these autopsies showed mild mucosal atrophy. There was also some degree of atrophy of the muscularis externa of the gastrointestinal tract.

The livers were atrophic, deeply coloured and dark brown, presenting a rather homogenous appearance with approximation of vascular territories. There was no mottling as one would see in chronic venous congestion or in a zonal fatty change. The spleens showed severe atrophy, with a weight of about 50–60 gm.

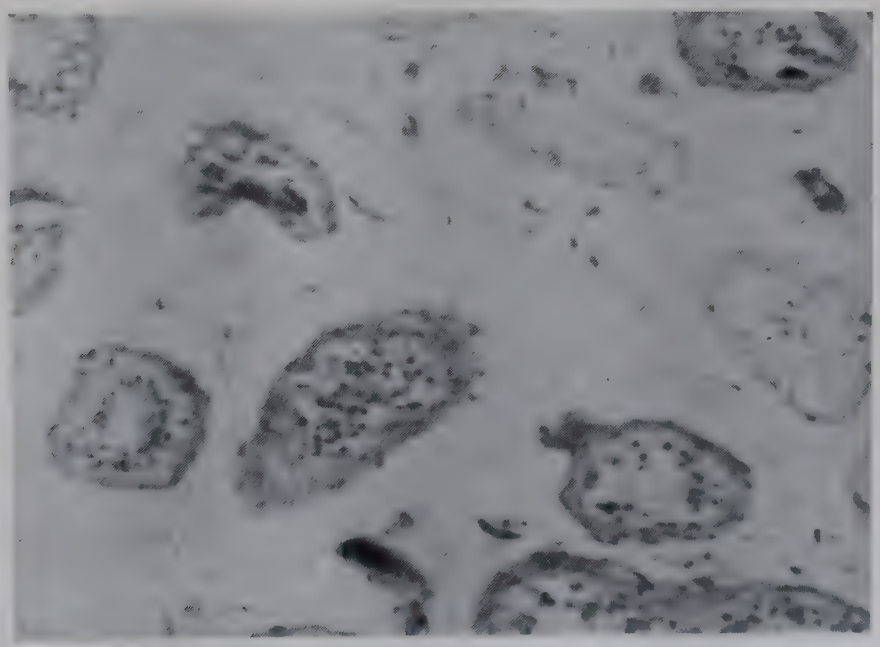

Fig. 9. Section of testis in a victim of hunger oedema, showing marked atrophy. H & E, × 120.

The capsule was wrinkled, showed focal thickening and sugar-icing, presumably due to the ascites. At the hilus, the splenic artery, bereft of fat, appeared prominent and tortuous. On cut surface the splenic pulp appeared dark and uniformly homogenous with prominent fibrous trabeculae. No white pulp was recognizable. The atrophy of the spleen was quite profound. Pancreatic weights are not available. The pancreas showed some degree of atrophy. Surprisingly enough, the pancreatic atrophy was not as severe as one sees in kwashiorkor. There was no pancreatitis or pancreatic fibrosis. The suprarenals were of great interest. Their combined weights amounted to 9–10 gm in each of the two cases in which they were weighed and in a third case, the suprarenals were of similar size. They appeared to be relatively large in comparison with the generalized atrophy all around. There were no cortical nodules. Their relatively large size may indicate that they did not lose weight to the same extent as the rest of the body. Each kidney weighed about 60 gm. The kidneys were pale with small colloid cysts under the capsule. There was no sclerosis, no pyelonephritis. The renal arteries were perfectly clear with no trace of atheroma. The testes were small and atrophic (Fig. 9). No other endocrine organ was available for study.

The cardiovascular system was of interest. The hearts were small and atrophic, their weights ranging from 60–100 gm. The sub-epicardial fat disappeared completely from the atrioventricular and interventricular grooves bearing the right coronary and the anterior descending and circumflex branches of the left coronary. The entire extramural coronary system stood out and was strikingly prominent with tortuousity and aneurysmal focal prominence of the vessels on the surface of the heart (Fig. 10).

Fig. 10. Heart of a case of hunger oedema, showing severe atrophy and extreme loss of subepicardial fat resulting in marked prominence of the coronary vessels.

The right atrium and ventricle were reduced to a paper thinness and the myocardium was brown and atrophic. The myocardium of the left ventricle was also atrophied, although not to the same extent. The heart muscle was soft, dark brown and crumpled under pressure. Microscopy revealed an extreme degree of atrophy of myocardial fibres with marked nuclear over crowding (Fig. 11).

Cross striations were inconspicuous. Muscle fibres exhibited cytoplasmic homogenization and lipochrome pigment was present. The loss of sub-epicardial fat was striking and was replaced by a basophilic mucoid change in the stroma (Fig. 12). This perhaps corresponds to the so-called gelatinous atrophy of the heart described in the older literature. The blood vessels, especially the aorta, the coronaries, the re-

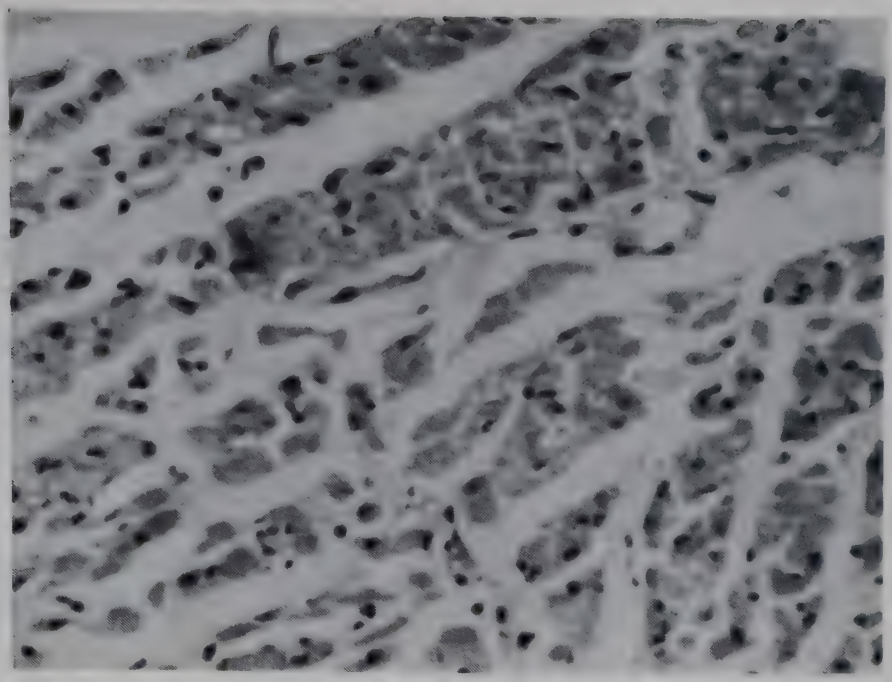

Fig. 11. Section of myocardium of a case of hunger oedema showing marked atrophy. H & E, × 120.

nal and carotid vessels were almost completely free from atherosclerotic lesions. This is of interest since 3 out of the 5 autopsied cases were between 50 and 60 years of age.

The most striking feature in the livers of the 5 patients who came to autopsy and of 15 others on whom a liver biopsy was performed during life was the very marked atrophy of the hepatocytes associated with prominent sinusoidal dilatation which was especially marked around the efferent veins. Liver cell nuclei appeared crowded in these areas. Fatty change was seen only in a small number of cases and when present, was mild without any specific zonal distribution. No case showed severe fatty change of the type seen in kwashiorkor. There was variable scarring of the portal tracts. The scarring was, in general, mild, accompanied by a variable degree of inflammatory cell reaction. Some cases showed thickening of the walls of the efferent veins which is of interest since none of the patients had con-

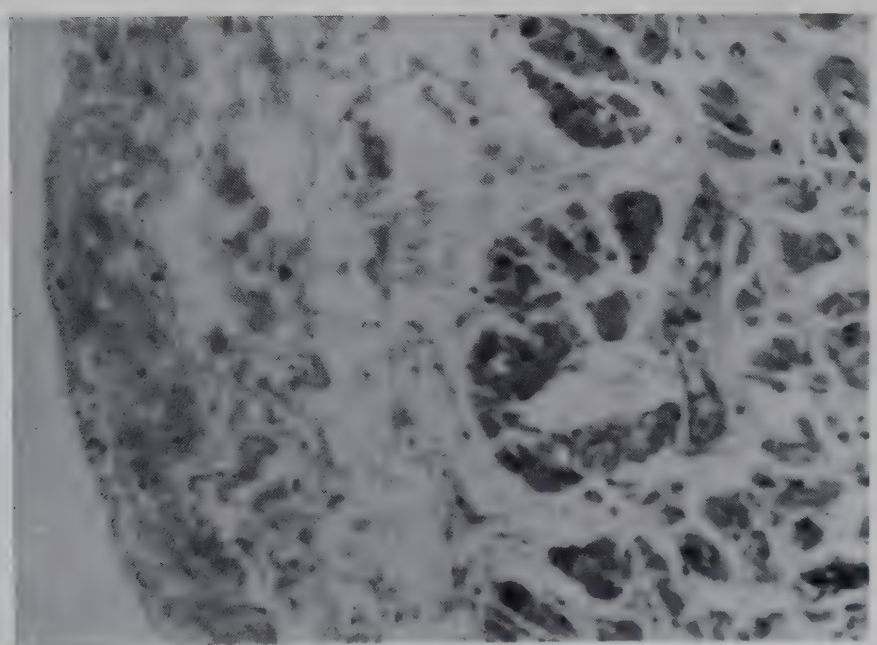

Fig. 12. Section of subepicardial zone of the left ventricle of a case of hunger oedema showing marked loss of epicardial fat and mucoid change. H & E, × 120.

gestive heart failure. An interesting feature was the presence of vacuolation of liver cell nuclei which was observed in a little over one-half of the patients. This was not confined to any zone of the hepatic lobule, but was seen in any area, perhaps a little more frequently in the mid-zones. The nature of this vacuolation remains uncertain, although it is considered likely that the vacuoles would contain glycogen. There is some suggestion that the presence and severity of nuclear vacuolation correlates with hunger oedema. Sherlock & Walshe (1951) observed glycogen vacuolation of liver cell nuclei in the undernourished population at the end of the Second World War. Many livers showed mild to moderate amounts of a pigment which resembled lipofuchsin. Its presence was not excessive. The changes in the liver on the whole were mild and non-specific. Atrophy of liver cell cords and nuclear vacuolation emerge as fairly characteristic, although non-specific, features of hunger oedema in this population.

Rehabilitation

The patients admitted to hospital were divided into three groups for purposes of testing the effectiveness of various therapeutic diets. Each patient in the three groups received a total of 3 000 calories. The amount and source of protein, however, varied in each of the three groups. In group I, 60 gm of protein derived mostly from vegetable sources was provided daily. In group II, an additional 20 gm of protein was provided keeping the calories constant, the source being milk protein. In group III, a similar supplement of 20 gm of protein was provided over group I, but the protein was derived from vegetable sources. The results of these studies have to be interpreted with great caution as the total duration of the study did not exceed 4 weeks. The field conditions under which these observations were made also place many limitations on their interpretation. Nevertheless, there was evidence to suggest that good therapeutic response was obtained on all three diets and there were no significant differences in the rate of recovery between the three groups. Considering that the diets comprised foods familiar to the people—rice, bajra, wheat bread, Bengal gram, potatoes, leafy vegetables, vegetable oil, cane sugar and milk powder, it is of interest that gastrointestinal upsets were relatively few and minor in nature during rehabilitation. The oedema regressed, ascites diminished, body weight diminished at first and in some began to increase. No diuretics were given. The younger patients showed quicker response. Old age and long standing oedema were detrimental to speedy recovery.

Mechanism of hunger oedema

Keys and co-workers (1951), McCance and co-workers (1951) and Sinclair (1948) have reviewed extensively the problem of how hunger oedema develops. The present study differs from the studies of these workers in that we are dealing, in Bihar, with a population that was chronically malnourished before the famine developed. The malnutrition in this population was further aggravated by infections such as tuberculosis and heavy intestinal infestation with parasites. Protein and calorie deficiencies and deficiencies of iron, vitamin B_{12} and folic acid were widespread. The genesis of oedema among the adult population in Bihar at the time of the famine would not be strictly comparable to the hunger oedema appearing in a previously well-nourished population which the studies of Keys, McCance and Sinclair deal with.

In Bihar, low level of serum albumin and of total circulating albumin mass was a striking finding in patients with hunger oedema. This was probably influenced by the previous state of malnutrition. As Table 5 indicates, serum albumin levels were low even in a rural community in South Bihar which did not show the effects of famine, although the levels were not as low as those observed in the patients with oedema. It is probable that diminished colloidal osmotic pressure due to low serum albumin is a significant factor in the genesis of the oedema.

There was no evidence of increase of venous pressure and the hydrostatic pressure in the capillaries was probably not elevated. The kidneys appeared normal under the light microscope and the limited studies of glomerular filtration rates did not indicate gross reduction. Response to water load showed significant retention of water by the oedematous patients. This, coupled with the finding of relatively large and well presented suprarenals, raises the question of the role of hormones.

Concluding thoughts

1. In Bihar, the famine conditions precipitated illness over a background of continued chronic malnutrition and a variety of infections and infestations. The Bihar famine is the unmasking of a colossal problem of chronic malnutrition in a population with no nutritional reserves. It is an environmental problem as Dr Whitehead remarked earlier this morning in connection with protein-calorie malnutrition. The food deficient in protein and calories, the tuberculosis, the anaemia and the parasites must all be tackled in a comprehensive manner through a multi-pronged attack. The treatment of one to the neglect of the other would mean that the response obtained would be submaximal.

2. It is perfectly possible to rehabilitate nutritionally deprived people of the area by the intelligent use of foodstuffs normally grown in that area and in other parts of India without having recourse to sophisticated and processed foodstuffs. Rice, wheat, pulses, millet and potatoes, all of which are common articles of diet, in suitable combinations and with a small amount of added milk protein, can bring about a remarkable change in the picture. Gastrointestinal upsets are a minor problem. Predigested foods are unnecessary and a luxury.

3. The emphasis that is often placed on distributing multivitamin tablets in times of famine is obviously overdone. Undoubtedly the millions of multivitamin tablets that were distributed to the famine victims must have done some good to the population. But these are not the primary requisites of the first order of priority in famine. It is understood that some 11 million multivitamin tablets were distributed in the Bihar famine.

4. Iron, vitamin B_{12} and folic acid are prime necessities in addition to calories and proteins. These must be given daily in adequate quantities and not as a portion of a mixture of a very large number of vitamins with low levels of these compounds. Iron alone, the cheapest drug now available to the physician, can do an enormous amount of good.

5. Studies on the mechanism of hunger oedema suggest that low levels of circulating albumin in the blood, coupled with the extensive loss of cell mass may play an important part in the genesis of hunger

oedema in this situation. The role of hormones remains to be determined.

On the 16th June, 1967, the first shower of monsoon came to this part of Bihar. Our patients still recovering in the hospital jumped out of their beds, went back to their homes and started to plough the fields. In the face of a gravest situation, they never gave up hope.

Acknowledgement

The authors would like to express their deep sense of gratitude to the Government of Bihar and to Dr Parimal Ghosh, Civil Surgeon, Hazaribagh District for the many ways in which they helped us in making this study possible.

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Summary of Discussion

Rapporteur: Wenche Barth-Eide

Jelliffe underlined the claim put forward by Passmore for simplicity in operations, as well as in trying to get the message over to people who are not technicians. *Nicol* agreed in principle on this, but he could not follow *Passmore* in considering the pound (weight) as a valuable unit for food rations, especially since the nutritive value would vary according to the food source. The general view among the following speakers was that the metric system should be adhered to.

Annan commented upon Ramalingaswami's classification of causes of famine: natural causes, crop failure and wars. In addition one must remember the large influxes of refugees; these are not necessarily due to wars but to political and social questions. These and large numbers of displaced persons within a country may also constitute another cause of famine.

Aykroyd wanted to know what effect the green revolution was going to have on the future of Bihar. *Berg* stated that there had been 67% increase in production of Indian wheat in 1970 over the production averages for the period 1960–65. For rice the corresponding figure was 20%. Total cereal production is well over a hundred million tons as against 72 million tons in 1966. Not everything connected with the green revolution is good news for nutrition advocates. With the increased production of cereals there has been a dramatic decline in the production of pulses, which is of course a very important protein factor in the Indian diet. During the last 4 non-drought years there has been a per capita decline in pulse consumption of 27%. As to what lessons one had learned from the Bihar experiences, *Berg* especially pointed out that those involved in relief operations were blessed with a form of pre-planning. Each state in India has a "famine code", a manual advising steps to take in case of monsoon failure. This details procedures on how to set up a food distribution system and works projects, how to handle the water supply, etc. The development of similar manuals for other countries was highly recommended. Second, the famine was used to gain recognition from officials at high policy levels that the long-lasting effects of malnutrition were more significant than the number of starvation deaths. As an outgrowth of this, India today has a national nutrition policy, for the first time it has a chapter in the Five Year Plan and an 80 million dollar budget for nutrition. Third was the recognition of the need for a permanent disaster control entity in India. As a result of the famine in 1966–67, India established a permanent office with responsibility to maintain awareness of the weather situation and of any scarcity in the country, as well as to train people and to coordinate them when disaster occurs. Fourth, the Bihar experience demonstrated the need for strong, centralized relief leadership. One individual should be in charge, with the authority to make rapid decisions, to transfer large amounts of food when necessary, and so on. People from the various ministries must be involved—through a coordinating committee—but this cannot take the place of a "famine dictator" who can make things happen.

Concerning alternate means of relief distribution, *Berg* referred to the extensive use of the school system as the most effective of the many delivery systems employed. In addition to students, pre-school aged children were taken by their mothers to the schools as the point for food distribution. This meant an unfortunate drop in the quality of education—in some cases, classes were suspended, but there was no choice. The value and flexibility of the voluntary agencies in this relief work was especially pointed out. Berg listed certain criteria for selecting foods for relief distribution, all with a view to simplicity: (1) easy to cook—with a minimum of utensils; (2) easy to transport under difficult conditions; (3) long shelf life; (4) preferably not attractive in terms of black market value, and (5) familiarity and acceptability.

Aall felt that the question of simplicity could not be over-emphasized. One of the most limiting factors when it comes to mass applications is the conventionalism of the experts. For example, if the need is for feeding stations of severely malnourished children, a clinician tends to think in terms of *beds*. These are expensive and have to be transported, while mats which people are used to sleeping on may cost two shillings and can be put down anywhere. Likewise, it may be difficult to convince a good clinician that infusions ought to be given intraperitoneally, as it may be difficult to use the veins in malnourished people—at least it needs experience. However, anybody can quickly be taught to put it into the abdomen. Realization of such things may make the difference of whether an assistance program will be effective or not. *Jelliffe* strongly supported these points, which he considered examples of the type of mass application needed in tropical pediatrics in general, and all the more so in the exaggerated state of a disaster situation. Scientific principles have to be carried out in a "compressed", simple and economical form, but medical people in the industrialized countries have so complicated their methods of therapy that they fail to realise that there is much that can be carried out by far less formally trained people who are given some practical instructions.

Vahlquist pointed out that the special needs of children had not been acknowledged until the last few decades, at least not in a realistic

way, in famine and starvation situations. After the Second World War, dried skim milk was distributed first without, then later with the addition of certain vitamines through UNICEF and others, on a very large scale. In the last few years the special low-cost, protein-rich weaning foods have come to the fore and he wondered if, in the Bihar drought, it had been possible to use any of these in a systematic way. *Ramalingaswami* reported that a great number of processed foods had been used, such as grain/milk combinations, CSM and Bal'-ahar. In fact, Bal'ahar production was stimulated and generated on a large scale as a result of the Bihar famine. No measurements had been made on children with PCM using any of the processed foods, but the general impression had been that they were widely acceptable and well liked by the children.

Forman wanted to know the implications of the kind of findings that emerged as a result of the recent experiences in India, for future emergency disasters in India and elsewhere. *Ramalingaswami* stated that basically one has to use a multipronged attack. One could use quite effectively the kinds of food that people are familiar with, and which may be grown in relative abundance in other parts of the country. There is then the question of storage and a fast mobilization of these resources from the surplus to the deficient areas. One should not send out a distress signal for highly sophisticated foods, if there are sufficient locally grown resources. When this is not the case, one has to use the kind of processed foods that were used in India, especially for the vulnerable groups for rapid amelioration of symptoms. Surplus stocks should be built up of specially fortified, highly nutritious food. One of the remarkable things of the Bihar famine was the lack of any serious epidemics. It is necessary to keep stocks of vaccines for protection against the common infectious diseases. As for tuberculosis, in India there is a national program for domiciliary treatment of tuberculosis. It is now possible to apply mass scale control measures against tuberculosis, and this ought to go along simultaneously with the relief measures, as the dietary supplementation then may be much more effective. Also a stock of iron tablets should be kept. Iron deficiency is not a famine problem but still part of the total picture, and it is not possible to improve the hemoglobin by simply giving protein foods, although protein depletion does play some role in the limitation of hemoglobin regeneration. The most important lesson that came out of it all, is that one has to attack the total environmental problem. It may be that the only possibility is to open relief centres and give out grains and pulses, but it is difficult to think of an effective control program in which other measures are not incorporated.

FAMINE CONTAINED: NOTES AND LESSONS FROM THE BIHAR EXPERIENCE

by Alan Berg[1]

"There is nothing so educative as a famine", said a British district officer in India a century ago (1), and for purposes of this Symposium, there may be no better example for study than the Indian Famine of 1966–1967. In short, the recent Indian crisis constitutes the first time in modern history that a government declared war on large-scale famine—and won. Ninety million people in eastern India were trapped in the worst drought since independence. Predictions of millions of starvation deaths appeared regularly in the world press. A Ministry of Food and Agriculture report described the famine as "a natural calamity of a magnitude unknown in recent times". Yet, the famine of 1966–1967 became known as "The Disaster that Never Was" (2), and "The Great Grim Famine that Wasn't" (3). Not that the crisis evaporated. Instead, a catastrophe was prevented, because of what *The Washington Post* described as "one of the biggest and most successful relief operations ever undertaken" (4).

This paper is not intended to serve as a "how-to-do-it" manual for famine relief programs. That is available elsewhere (5). Rather, it will attempt to discuss famine by examining the backdrop of the India crisis, looking at activities which were attempted, evaluating results, and seeing what insights may be gained which might have applicability elsewhere.

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Famine, of course, was no stranger to India; an extensive literature documents the toll it has taken over the centuries. In 1769–1770, an estimated one-third of Bengal's population of thirty million perished,[2] and other millions died in subsequent grim

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[1] U.S. Drought Relief Coordinator in India (1966–1967); Chief of Food and Nutrition Division, U.S. Agency for International Development, New Delhi (1966–1970); currently Senior Fellow, The Brookings Institution, Washington, D.C., and Belding Scholar of the Association for the Aid of Crippled Children, New York. The interpretations and conclusions are those of the author and do not necessarily reflect the veiws of the above organizations.

[2] Graphically described in W. W. Hunter's *Annals of Rural Bengal,* published in 1868: "All through the stifling summer, the people went on dying. The husbandmen sold their cattle; they sold their implements of agriculture; they devoured their seed grain; they sold their sons and daughters, till at length no buyer of children could be found; they ate the leaves of trees and the grass of the field; and in June 1770, the Resident at the Durbar affirmed that the living were feeding on the dead. Day and night a torrent of famished and disease-stricken wretches poured into the great cities. At an early period of the year pestilence had broken out. In March we find smallpox at Moosshedabad, where it glided through the vice-regal mutes, and cut off the Prince Syfut in his palace. The streets were blocked with promiscuous heaps of the dying and the dead. Interment could not do its work quick enough; even the dogs and jackals, the public scavengers of the East, became unable to accomplish their revolting work, and the multitude of mangled and festering corpses at length threatened the existence of the citizens."

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famines of the 18th and 19th centuries. Improved transportation and more sophisticated communication did much to lessen the blow of famine in modern times, and this, in part, is why India was spared during the first four decades of this century. However, even these improvements do not prevent a peculiar set of circumstances from culminating in disaster. Still fresh in the minds of many adult Indians is the Bengal Famine of 1943, when millions died[3] and two-thirds of the sixty million inhabitants of Bengal were said to be destitute. "So many people collapsed on the sidewalks that, at times", reported a contemporary *Newsweek* account (6), "the authorities despaired of being able to collect and cremate the bodies".[4] These victims, in a way, were casualties of World War II; the number of Indian dead was four times greater than the total number of Americans and Britons—civilians and military—who lost their lives as a result of enemy action, and probably higher than the number of Germans killed. The Japanese invasion of Burma had closed off the normal supply of imported rice. Added to this, the normal domestic rice production was cut 25% as a result of a cyclone, torrential rains, three tidal waves, a related crop fungus and "root rot". From the limited food that was available, India was called upon to feed armies at home and abroad and to care for thousands of refugees from neighboring invaded countries. Also, once Burma and Malaya fell, there was fear of invasion of India itself, and small farmers were reluctant to bring surplus crops to market. Hoarding became a major problem.

The genesis of the Indian famine of the mid 1960's was different. It was brought on by two successive years of drought, a phenomenon which may not have occurred more than once or twice in the last hundred years. In the crop year 1965–1966, the drought was extensive, affecting seven states. The following year, some of the same states were again afflicted, with the drought in the eastern part of the country being of unprecedented intensity. A grain shortfall of nearly thirty million tons over the two-year period[5] depleted food stocks of producers, traders and consumers. Although the famine was a national disaster, the emphasis in this paper will be on the eastern state of Bihar. It was in this historic,[6] once

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[3] The number of starvation deaths has been a disputed issue. The Famine Inquiry Commission, established by the British controlled government, concluded that "about 1.5 million deaths occurred as a direct result of the famine and the epidemics which followed in its train". C. Subramaniam, Minister of Food and Agriculture at the time of the Bihar Famine, says the Bengal report was designed to cover up the true magnitude of the tragedy, and that there were more like three to four million deaths. Although numbers vary, the general view is commonly held among today's senior Indian officials in Delhi that the Bengal death figures were probably much higher than officially reported.

[4] There are uneven accounts of response to the need. A. L. Dias, a senior civil servant who has studied the Bengal famine, calls it "a big blot on the pages of British rule in India" (7). Another senior Indian Government secretary candidly traces his political bias to the British handling of the famine. "... After considering all the circumstances", says the official *Famine Inquiry Commission Report on Bengal* (p. 105), "one cannot avoid the conclusion that it lay in the power of the Government of Bengal ... to have largely prevented the tragedy of the famine as it actually took place." In some quarters there was also dismay about lack of more positive response from the U.S. (8).

[5] From more than 88 million tons in 1964–65 to 72 million tons and 74 million tons during the two drought years.

[6] Buddhist, Hindu and Moslem history all had important chapters in Bihar. The capital, Patna (then Patliputra) was capital of the Mauryan Empire. Bihar is best known, perhaps, as the place where Buddhism was founded. Under a tree in what is now called Buddh-Gaya, Prince Siddhartha found enlightenment and became the Buddha.

richly endowed area that the famine was most intense, the causes most dramatically graphic, and the relief activities primarily centered and most successfully performed.

Bihar, though rich in mineral resources, is primarily an agricultural state, with nearly nine-tenths of its population of 53 million engaged in farming. Its population, the second largest among Indian states, is roughly equivalent to that of France, and few Biharis were unaffected by the crisis.

Poverty is endemic in Bihar. The *zamindar* (landlord) system, started as a control device by the East India Company in the late 1700's, has left its feudal mark. Thirty-eight percent of the population belong to scheduled castes[7] and tribes. Of the sixteen million agriculturists, more than a quarter are landless laborers. The per capita income in Bihar—U.S. $27.00 a year—is India's lowest. Even in the best of times, Bihar is a deficit state in food grains, and the reasons for this are not hard to find. Of the 27 million acres sown to crops, less than a fifth are irrigated. And then only a third of these—or seven percent of total cultivation—are irrigated from assured sources, and thus invulnerable to a poor monsoon. A promising tubewell development program was under way after independence, but this was halted more than a decade ago; this despite the fact that much of Bihar sits atop one of the world's largest reservoirs of ground water. Irrigation schemes had been unduly delayed for a variety of political and administrative reasons.[8]

The official Bihari administration in recent years could never have been mistaken for a model of efficiency. Indian newspapers in the early days of the famine described the state administration as "incompetent", "bungling", "unimaginative", and "unresponsive". Criticism of local Congress Party politicians came from many quarters. A headline in *The Hindustan Times* declared, "Power Politics While Bihar Starves" (9), and *The Statesman* described Bihar politics as "a whole-time occupation. They (the politicians) think of nothing else except the elections ... they have no time to think of the drought or the starving millions" (10). "The story of the Bihar famine", suggested one British observer, "is the story of a human wasteland, where the rich care not, the poor dare not, and those in office fear not" (11). Wrote George Verghese, the Prime Minister's Information Advisor, "Famine has revealed the true condition of Bihar—its abject poverty born of agricultural and general economic stagnation, social and educational backwardness, an oppressive caste system, an inequitous and inefficient land structure, and forms of slavery like *kamauti* or *kamia*[9] that are still extant" (12).

Added to these chronic problems, Bihar's capacity to withstand drought had been weakened by the drought of the previous year. Reserves of food grains, necessary for seeding as well as for food, had by and large been consumed. The fall crop (known as the *kharif*) was one-fourth the normal, and in some areas was almost a complete

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[7] A euphemism for untouchables.

[8] The acreage of irrigated land in Bihar probably declined from independence in 1947 to the famine of two decades later. An ancient, elaborate irrigation system had been the responsibility of the *zamindars,* and when this landlord institution was "nationalized", there was insufficient upkeep of the existing irrigation system.

[9] *Kamauti* is a kind of bonded labor, a debt bondage fixed for a specific period. This might be for a few years, a lifetime or even hereditarily descending from father to son in some cases. *Kamauti* grew out of acute helplessness of tribal and semi-tribal communities caught in a precarious subsistence economy. The system is known by various names in different parts of the state. In South Bihar, it is called *kamia.*

failure, e.g., in Palamau District, the crop was two percent of normal. Moreover, the important February–March rains required for the spring (*rabi*) crop did not arrive with sufficient force, resulting in production of half the norm. By cruel contrast, the North Bihar Plains were hit with heavy floods toward the end of August.

In short, Bihar seemed singularly unprepared to cope with the situation it faced. As a result of the previous year's drought, the cupboard was bare.[10] The administrative apparatus was less sophisticated than in most other Indian states. Also, Bihar was one of the few states that did not have a large child feeding program that could be used as a base to a relief effort, and a base is not easily or quickly built in a state with 70 000 villages. All of this led to the conclusion in a briefing to American Ambassador Chester Bowles and his staff in November 1966 that "although there is still much uncertainty and, in some quarters, much confusion, we are watching unfold what could be a tragedy of major proportions".

It should be noted, in retrospect, that at the time of the monsoon failure, there were also unexpected assets on the balance sheet. Because of the smaller drought the previous year, the federal Government had the advantage of a "dry run" in establishing relief machinery, setting up fair price shops, transporting mass quantities of grain and streamlining the port capacity to bring in more grain. Similarly, the larger voluntary agencies picked up useful experience in hurriedly developing extensive feeding programs in other states. Also, by good fortune, considerable quantities of food were already en route to India, partly, delayed shipments from the previous year and, partly, shipments for normal child feeding programs.

For all its backwardness, Bihar had a basic administrative structure which lent itself to effective famine relief operations. Transport and storage were adequate. The existence of the Education Department network and its capacity to adapt to famine relief programming turned out to be a crucial element. Finally, Bihar had a prepared, published, well-distributed Famine Code which specified appropriate actions to be taken under differing conditions as they developed.

The picture in the fall of 1966, however, in balance was bleak, As the federal Government in New Delhi (known as the Centre) began receiving reports in September and October of the impending starvation, inter-ministerial survey teams were dispatched to the field to make a comprehensive study. Their reports were increasingly disturbing, and in early November Prime Minister Indira Gandhi personally toured the drought areas of eastern India. Upon her return, she reported to the nation:

> As I broadcast to you tonight, my heart is filled with great sadness. Countless millions of our people, men, women, children, in Bihar and Uttar Pradesh and parts of other states as well, have had the bread taken out of their mouths by an abnormal failure of the rains from mid-August onwards. Green fields that promised an abundant harvest have withered. The grain has died on the stalk. The toil and sweat of months have been reduced to dust. There is hunger and distress in millions of homes.[11]

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[10] It is ironic that the most dominant structure in Patna, the capital of Bihar, is a bizarre 90 foot high granary known as the Golaghar. This was built after the Famine of 1770, at the instigation of Warren Hastings, "for the perpetual prevention of famine in these provinces". The Gola is built of bricks, with a capacity of 137 000 tons of grain. Unfortunately, there were architectural problems. The idea was to carry grain up an imposing outside spiral staircase and pour it through a hole in the top, a feat not easily achieved. If this

To some, the Government's concern and response was slow in developing. The Indian bureaucracy, like most, is a cumbersome piece of machinery, which does not maneuver into position overnight. When it does, it has the capacity to move effectively, as it clearly demonstrated in this case. The ultimate result of a campaign is, in the final analysis, the best measure of performance, and the extraordinary achievement in the Bihar famine relief effort is there for all to see.

The major need, of course, was food, and the prime objective of the Indian Government's relief program was to obtain sufficient supplies of food and to dispense it equitably to those in want. The distribution system followed the traditional Indian plan for meeting scarcity conditions. The basic outlet was the fair price shop—20 000 of them were established in Bihar—through which nearly a million and a half tons of grain were distributed at fixed subsidized prices[1] to an estimated 47 million people in 1967.[2] A second program permitted nearly a million aged and infirm to obtain ten ounces of free grain a day, and a third, the child feeding program, at the famine peak provided approximately six million children and mothers with one free meal a day.[3]

Throughout the relief effort, a conscious attempt was made to concern government authorities with the nutritional dimensions of the famine in both its human and national development aspects. Many officials were vaguely aware that malnutrition was linked to the high Indian death rate. Some also knew the relationship of malnutrition to physical retardation. Many, however, were being exposed for the first time to recent research findings suggesting a connection between protein deprivation and the sluggishness commonly observed among the extremely poor. Officials travelling in the famine areas began noticing evidence previously ignored, and the apathetic eyes of the youngsters left their mark. George

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were not a sufficient challenge, the doors at the bottom opened inward, rendering them useless when the granary was full.

[22] This radio speech, which also established a National Drought Relief Fund (see p. 127) was broadcast on All India Radio, November 18, 1966. A later appeal by the Prime Minister was made on April 30, 1967.

[1] To provide purchasing power to buy food at the fair price shops, relief works schemes were authorized. In addition to providing badly needed employment to millions of Indians, these activities served to check migration. Most of these projects required heavy manual labor, such as earth moving by agricultural laborers. The projects were developed and/or approved by the local officials, but were run by private contractors who supplied the needed equipment. In principle, a laborer could dig a cubic foot of dirt a day and therefore receive from one and a half to two rupees a day—enough to buy his food ration. (An Indian rupee is worth U.S. $0.13) However, because of the workers' debilitated condition and the cut taken by the contractors, pay usually averaged out to somewhere under a rupee. F. C. Gera, coordinator of the Government's relief operation, reports the relief works were "not without abuse . . ." and as time went on, the relief programs were tightened and many gradually withdrawn from the local contractors. Some of the projects will have continuing value (see below). Others (many of the roads and road shoulder improvements) deteriorated with the monsoon of 1967. A major promoter of the relief works concept was Jagjivan Ram, who became Minister of Food and Agriculture when C. Subramaniam lost out in the 1967 election. The new Minister was from Bihar, representing those classes most in need of help. He was described by his Food Secretary as "a pillar of strength in those (famine) days (who) brought to bear a pragmatic approach to the many problems that arose."

[2] The amount of the rationed grain depended on the extent of the need—from four ounces a day per adult in urban areas, to eight ounces a day in the hardest hit sections. The latter was raised to ten ounces when famine was formally declared in April, 1967.

[3] There were also a number of free kitchens run by local voluntary agencies, the number of beneficiaries is not clear, but is probably in the hundreds of thousands.

Verghese illustrated the new attitude after surveying the famine area for Mrs Gandhi:

> There have been few genuine starvation deaths ... The real, more permanent, insidious and dangerous problem is that of malnutrition which is no more than an aspect of poverty. There are many protein-deficient, pot-bellied but otherwise pinched children in Bihar as elsewhere in India. It is quite common to be told that the people are lazy, indolent, stupid. Angry words, but true—and the result of malnutrition over several generations. It is easy to fight an epidemic. It can be seen, defined, controlled. And then it's over. Hundreds of thousands of children and adults have been vaccinated against smallpox and cholera in Bihar this year. But malnutrition is less tangible, more pernicious. Over the years, it results in stunted growth, mental retardation, "aches and pains", "lethargy", low vitality and low resistance to disease. The economic cost to the nation of the consequent human inefficiency has never been calculated. It must run to hundreds of crores[4] of rupees each year—another factor in the vicious circle of poverty (13).

The new attitudes were reflected operationally in policies and relief programs favoring children. The new concern led, for example, to the hurried development and production of a special nutritious food for these children. During the previous year's drought, Professor Nevin Scrimshaw of M.I.T. had visited India for A.I.D. to survey nutrition needs and opportunities. During the trip, Scrimshaw, in conjunction with the scientists of the Central Food Technology Research Institute in Mysore, recommended and formulated a cereal-based, high protein food which became Bal Ahar (in Hindi: "Child's Food").[5] Indian groundnut (peanut) meal, until then rarely processed for human consumption in India,[6] along with Indian vitamins and minerals was added to imported American grain. In early 1967, a decision was reached by the Food Ministry "to include all expectant and nursing mothers and all children between two and fourteen years of age in a program of distribution of Bal Ahar" (14). The product was processed and packaged by Indian industry and distributed by the Indian government. Bal Ahar was produced hurriedly to meet the famine need and was not without problems, such as quality control in manufacturing, which come with such speed.[7]

Famines usually connote the need for food. The need for water is often as great (15), and in parts of Bihar, it sometimes became the more critical.[8] The logistics of food are much simpler: once available, food can be transported. The movement of water is more complicated. The scarcity of water posed health hazards, especially in the hottest months of the year (temperatures of 120°F are not uncommon in the Bihar Plains). It also threatened the food distribution system; if lack of drinking water caused the migration of large numbers of villagers, the delicate food distribution apparatus might collapse.

To provide each person a minimum of two gallons of water daily, the Government developed a two-pronged program of well drilling and water transport. The core of the program was the hand-digging of small mud wells (known as *kutcha*) and the conversion of the *kutcha* wells to *pukka* (good

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[4] A crore is 10 million rupees, approximately U.S.$1.3 million.

[5] The specifications devised for Bal Ahar later were accepted as international standards for blended foods by the Protein Advisory Group of the United Nations.

[6] i.e., with a nutrition end in view. Hydrogenated oil from the Indian groundnut has long been popular as a cooking medium.

[7] Improvements were made and Bal Ahar later received high marks for acceptability.

[8] Although estimates vary, approximately 13 million people in more than 18 000 villages were without an assured drinking water source within one mile of their residences.

wells) by lining them with brick.[9] Without lining, the wells could be expected to cave in with the next heavy rains, but even as temporary devices, each provided drinking water and irrigated half an acre of land until May and June, the driest period of summer. The water needs not met by the well program were covered by an elaborate water carriage system: by truck and rail, water was shipped daily to storage centers, from which it was transported further by large army water tankers and a fleet of bullock carts. People were assured that at given spots on certain days they could pick up water, just as milk delivery is carried out in other countries.[10]

Frequently famine is accompanied by widespread disease, and in some cases, deaths from such epidemics outnumber deaths from starvation. During the Bengal Famine in 1943, cholera, smallpox and malaria all took a major toll. Although the latter has been virtually eradicated from India, much concern about the other two remained. Since the incidence of cholera is related to malnutrition, there was valid cause for fear. Similarly, an abnormally high number of smallpox cases led some journalists to suggest the beginnings of an epidemic. Inoculations[11] and well-disinfectant treatments were extensively carried out, and the epidemic never developed. In fact, no doubt partly as a result of these efforts, the number of cholera cases was substantially lower during 1966–67 than the two years before or after. Smallpox, also, has declined from pre-drought figures, once the outbreak mentioned above was brought under control.

Need for accurate, timely information was recognized as essential for successful control measures, and a team of management systems specialists designed an information reporting system to improve the flow of data. Techniques were instituted to communicate in days messages which normally took months to chug through layers of bureaucracy. In some important instances, the data was communicated in hours and minutes—via telegraph and long distance telephone, otherwise infrequently used mediums for conducting local government business. Radio was employed for regular famine bulletins to keep field work-

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[9] Figures on this are unreliable, but indications are that half a million *kutcha* wells were dug in Bihar, and perhaps another 10 000 were converted into the better *pukka* wells. Given more publicity but perhaps of less immediate effect, was the sinking of tubewells—some 25 000 sunk or deepened during the drought period. The Government reports that nearly twice the number of water supply projects were undertaken than were originally sanctioned; the cost of the Bihar drinking water program reached nearly $15 million.

[10] To put the above recitation in context, it should be noted that the Bihar water program was not as successfully handled as other relief activities. Mismanagement and poor implementation of projects seemed endemic. A significant problem was the quality of the pumps. A sample survey revealed that as many as half the hand pumps had broken within two months of installation (however, as a reflection of the prompt response to such problems, three mobile teams were established to check and repair the pumps). Although the water program undoubtedly was of considerable value, the critical Bihar drinking water situation probably was alleviated more by the fortuitous arrival of unseasonal rains in March, April and May of 1967. The rains raised the water table, provided fodder, and in general, enabled Bihar to survive the cruel months of April through June.

[11] The speed of response reflects well on how quickly large bureaucracies can move in an emergency. The Indian Health Ministry was becoming increasingly concerned about a possible smallpox epidemic, and a formal request was submitted to AID by the Health Ministry on a Saturday morning. Within twenty-four hours this had been approved in Washington and transmitted to the Communicable Disease Center in Atlanta. Packing began immediately and by Thursday of the following week, ten million doses of freeze-dried smallpox vaccine, twenty-six ped-o-jet injectors and four smallpox inoculation specialists (who trained Indians in the use of the injectors) had arrived at New Delhi's Palam Airport.

ers abreast of the rapidly changing situation. In a master Control Room, data was collected and charted on food stocks, disease rates, deaths, water levels, crime rates, food prices, and numbers of people participating in relief work activities. If, for example, the water level in an area was reported to be reaching bottom, appropriate actions could be taken in anticipation that people might soon be on the move. The number of people attending free kitchens and work projects also reflected the degree of need. Similarly, the rate of food looting provided a measure of the local condition.[12]

Finally, there was the problem of maintaining some semblance of economic stability. At the height of the famine, Bihar was prostrate. Seed had been consumed, many farm animals had succumbed, and money for agricultural necessities was unavailable because of the crop failure. Prices of food grains in some places had doubled and tripled, and certain development projects were stopped in mid-construction.[13] Recognizing that any chance of a crop for 1967–1968 required revitalization of the rural economy, the Government provided Biharis $32 million in loans ($85 million throughout India) to purchase seeds, fertilizers, animals and pesticides.

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[12] A word might be added about the local administration of the relief program. Under the Indian Constitution, direction of a state drought relief operation is the responsibility of the state government. Delhi was concerned about the Bihar administration but decided, apparently on political grounds, against the imposition of President's Rule, i.e., superimposing Federal administration on the State. It deputed two senior officials; the first being B.D. Pande, who took over as Chief Secretary (the senior civil service role of a state, in contrast to Chief Minister, who is the top political figure, comparable to prime minister at the federal level). Pande's predecessor retired under pressure from Delhi for "reasons of health." The other was P. K. J. Menon, who became Delhi's man in Bihar, and the controller of federal purse strings. The quality of the Bihar administrative service varied by individual, locality and department. Government officials in New Delhi concluded some performances were of heroic proportions, others disappointing. In general, for a state of Bihar's administrative reputation, the performance was better than expected. No doubt, the presence in the field of newsmen and personnel from voluntary agencies, other governments and private bodies substantially affected the quality of work of Bihar officials and Bihar institutions. The local officers were under close scrutiny. It was difficult for them to make a move without its appearing in the press.

Bihar politicians left most of the relief efforts to the civil servants, and although this probably would have been normal in any case, the fact that there were February elections insured it. In some instances, the election hindered relief operations, detracting from the energies and, on occasion, the facilities of relief work. Similarly, there were political pressures which funneled relief to areas not always of greatest need. However, the positive, often unintended, benefits of the election outweighed the problems. For example, the election drew more attention to the food needs than otherwise would have been the case. Political pressures and concurrent electioneering virtually guaranteed that no needy areas were missed. Similarly, the election provided an escape valve for the frustrations of the suffering. Possibly these frustrations might have been vented in quite a different form had there not been this outlet.

In the election, the incumbent Bihari Congress Party was overwhelmingly defeated (e.g., Chief Minister K. B. Sahay failed to receive from one of the two constituencies the necessary 1/6 of the total vote, which is required if a politician is not to lose his otherwise refundable election candidacy deposit) and the new coalition regime demonstrated prompt concern, including issuing a formal declaration of famine. This was a matter of some significance—and some dispute. The food need was recognized, but also recognized was the image such a declaration would imply—both at home (and the hoarding this might lead to) and abroad. In related steps, the new Bihar government extended the recovery of loans from cultivators, gave permission for remission of rent, and issued special powers to top officials to sanction new positions and to transfer men more easily. Powers were given to draft officials for the famine effort and to requisition any state vehicle for relief work. Additional gazetted officers, engineers and overseers were deputed to famine areas for the relief projects. The Life Insurance Corporation of India did not insist on premium collections from agriculturists during this time.

[13] Because of the crisis, implementation of India's Five Year Plan was deferred.

III

In 1966–1967, more than 20 million tons of food grain were moved into drought affected areas of India, much of this from abroad,[1] but also much from elsewhere in India.[2] During the crisis, the Indian Government loaded and moved an average of seven trains a day—50 cars per train—an average of 550 miles. By the end of 1967, 153 000 fair price shops were operating in the country (20 000 of them in Bihar, the ration system benefiting 47 million Biharis) and six million people were involved in relief works projects (700 000 in Bihar). Programs for youngsters and destitutes reached nearly 20 million (seven million in Bihar) during the two years. The cost of all this: somewhere in the vicinity of $700 million (perhaps $200 million of it spent in Bihar). Help came from many foreign quarters, but the major flow came from the United States which provided one-fifth of its wheat crop. This constituted an unprecedented movement of food from one country to another and required an armada of some 600 ships.[3] These docked at a rate of three ships a day, depositing an average of two billion pounds a month. Lester Brown (16) estimates an equivalent of 60 million Indians were sustained for two years solely by these shipments.[4]

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[1] Indian officials were caught up in what to them seemed an embarrassing situation. They needed help, but at the same time were sensitive to the image that their need projected. Madame Pandit, in an earlier Lok Sabha (lower house of Parliament) speech, had said, "In my heart I know that each bag of grain that comes to this country lessens our belief in ourselves." Yet F. C. Gera, the coordinator of the Indian Government's famine effort reported, "it was clear that India could not pull through the difficult period ahead without substantial aid from friendly governments and international organizations" (17). Mr Gera commented, "there was some criticism in India that small collections were being made from schools, churches, etc., for drought relief and that this was tarnishing the image of India in foreign countries. That the image of a big country like India which cannot feed itself and has to ask for assistance from foreign governments and organizations would be tarnished to some extent is undeniable."

[2] The latter was not without problems. Reallocation of domestic supplies was cause for several serious Centre/State confrontations.

[3] There were challenging logistics problems in a pipeline extending from the Great Plains to Bihar. In the U.S., innovative procedures were developed to speed the heavy flow, e.g., a new technique of one-way loaded chartered trains, sent directly to port (without the usual stops), and then returned immediately for reloading. The thousands of miles traveled by empty trains represented a departure from practice, but was a quick and efficient means of moving massive amounts of food. Once the trains reached port, among the ships for loading was the 100 000 ton supertanker *Manhattan,* used for the first time to carry grain. As it neared Indian ports, the *Manhattan,* because of its size, would unload to smaller vessels to take the food to dock.

[4] The U.S. aid was accompanied by anxiety and controversy, most of it centering around policies and attitudes of President Johnson. In 1966, the American President had been responsive to the Indian food need. Once he decided to help, Johnson gave all-out support, as he communicated in a late-night telephone call to his Secretary of Agriculture, Orville Freeman. The latter recalls that he was instructed to "do everything you have to do to get the food moving ... We're not going to let them starve ... I hold you responsible ... This is a way to earn your merit badge."

The following year was a different story. The President anticipated difficulties with Congress, in part because he did not believe that India had sufficiently examined aid alternatives from abroad, or had done all it could to re-allocate supplies within India. Also, one could not ignore the domestic repercussions of the grain aid. Wheat stocks were at a fourteen year low. The Chicago Board of Trade was near chaos because of the enormous volume. Prices of wheat and cereal products were driven up, creating political difficulties. The President's decisions for more food aid were required at a time when American women were picketing supermarkets because of high prices. There was also another factor. Interviews by the author with some of the key characters of the drama (Minister C. Subramaniam; Indian Food Secretary A. L. Dias; Secretary Freeman; Lester Brown, a chief advisor to Freeman; and Edward Hamilton, then of the White House staff) all reflect that Johnson's intention, at least initially, was to use the bait of U.S. food aid at a time of critical need to bring about reforms in Indian agricultural policy. This took the form of

What was the result of this unprecedented effort? Foremost, large scale deaths from starvation were prevented. Some died, although the number probably is not large[5] and certainly nowhere near the millions predicted in the early days of the crisis. The discrepancy is not because predictions at the outset were ill-founded, but as Food Secretary A. L. Dias said, because of the substantial program which prevented tragedy on a large scale.

The major and most direct reason for success was the food distribution program in its many forms. Although not without problems, these programs generally were effective, and many were effective to the point that (in the words of Minister Subramaniam) "the state of children's health was much better than at any other time". Wrote George Verghese:

> For the poorest sections of the society, 1967, the Year of the Famine, will long be remembered as a bonus year when millions of people, especially children, probably for the first time were assured of a decent meal a day ... in a "normal year", these people hover on the bread line. They are beyond the pale, nobody's concern, they starve. In a famine year, they eat. Their health is better and the children are gaining weight. For them this is a year of great blessing. This is the deep irony, the grim tragedy of the situation (18).

There was probably more milk in Bihar in 1967 than there had ever been before and, in the judgment of some, may ever be again. Philip Harvey, a Bihar relief veteran from CARE, calculated (19) that more than

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delayed decisions and, once decisions were reached, short-term food aid approvals measured in months, rather than the multiyear commitments which had been customary. According to Subramaniam, the reforms were already underway, and Johnson's delays "only made things difficult". (In addition to general policy difficulties, Subramaniam, in February 1967, lost his seat in Parliament and, as a result, his Ministry—a defeat he attributes to the domestic political criticism he received because of the Johnson food hold-ups.) "The delays", Subramaniam said, "served as an irritant instead of forceful direction, as intended." Dias points out that the time he devoted to second-guessing President Johnson and to preparing answers to critical questions being raised in the Indian Parliament, seriously detracted from the more important need of administering the relief effort. Other Indian officials complained that the uncertainties of American aid made planning difficult. They also suggest that the episode reflected the lack of policy influence of high American officials stationed in Delhi, an attitude which had repercussions after the famine was over. Among certain elements of India's leadership, Johnson's handling of the food aid contributed much to the deterioration of the American image in India—this at a time of record amounts of U.S. aid. A number of possible motives, inappropriate for discussion here, have been attributed to the Johnson policy (a policy described by one concerned Indian newspaper editor at the famine peak as "brinkmanship of the highest order"). Supporters of the Johnson policy, in retrospect, contend his approach, combined with the general food scarcity in the world, brought about policy changes and resource allocations that would not have happened otherwise. The related resentment, they suggest, led to a strengthening of resolve—a determination by the Indians not to let it happen again. Evaluation of the Johnson strategy is a difficult task. The food eventually did arrive in time and in sufficient and unprecedented quantities. Starvation deaths were prevented and agricultural policies were radically altered, as best reflected in the successes of Indian agriculture since the famine. Whether these policy changes and resulting successes would have occurred without the pressures and without the above-mentioned problems emanating from those pressures will be an issue for the historians.

[5] Nor is it very clear. Charges of starvation deaths and refutation of these charges appeared regularly in the Indian press. Few, however, were reported formally (The official figures for 1966—released March 15, 1970—reported 219 starvation deaths nationwide, seven of these in Bihar). Local officials were personally held responsible for starvation in their jurisdictions and thus, any report from them of a death would reflect their own inability to prevent it. As a result, deaths were sometimes attributed to other causes. From sorting through the available information, much of it observational from people working in the famine areas at the time, one might conclude there may have been hundreds, and, by some estimates, up to several thousand deaths caused by the famine.

a ton of nutritional iron was ingested by the traditionally anemic population, along with substantial quantities of other minerals, vitamins and proteins. These nutrients, which were reasonably carefully supervised, had an undoubted impact on the health and well-being of millions of young Biharis.

The emergency program—and its success in preventing death and acute malnutrition among children—dramatized the importance of nutrition to the Government, and officials began looking at malnutrition not just through humanitarian eyes, but as an issue of national growth and development. The famine was directly responsible for the production of Bal Ahar, a food scheduled in 1971 at 100 million pounds a year,[6] which perhaps might never have come into existence had there not been this extraordinary need. It was the famine which led to the interest, and, in some cases, emotional commitment, of a number of senior government officials, which in turn led to a variety of programs, a national nutrition policy, and a chapter on nutrition for the first time in the Five Year Plan.

Minister of Food and Agriculture, C. Subramaniam, later serving as Acting President of the Congress Party, was responsible for the adoption of a Children's Charter (guaranteeing minimum nutrition levels to pre-school age children) as a major plank of the Party platform.[7] The Secretary of Food, A. L. Dias, who was in large part responsible for the success of the relief program, soon after the famine became the key government advocate for a national nutrition program. George Verghese, who was Information Advisor to the Prime Minister, later became, as Editor-in-Chief of *The Hindustan Times*, the nutrition movement's spokesman with his frequent editorials calling for action. I. Mahadaven, who was Personal Secretary to Minister Subramaniam, was made the Managing Director of Modern Bakeries and became interested in introducing India to fully fortified bread, special nutritious products for the needy and a national nutrition education program. Kalyan Bagchi, the Health Ministry's representative to the famine survey teams, became the leading force in the Health Ministry on nutrition matters. It was Bagchi who was later responsible for the first Comprehensive Nutrition Plan, a forerunner to the systems approach to nutrition now being examined in various international quarters. N. P. Sen, the Managing Director of the Food Corporation, which produced Bal Ahar for the famine relief effort, was instrumental in the formation of the Protein Foods Association of India.

There were other developmental implications with nutritional overtones resulting from this experience. During the famine, as many wells were dug as during the three previous Five Year Plans, and three times as many wells were energized. There were projects for field leveling, embankments, drainage and restoration of old water tanks and irrigation ditches which had fallen into disrepair. Farmers displayed an increased interest in purchasing fertilizers, pesticides, and new seed varieties; much of this the result of the increased irrigation and the stepped up agricultural extension work which went along with it.

The famine also brought into promi-

[6] The Bal Ahar production scheduled for the current school year is 60 million pounds, a figure *four* times larger than the total production of all similar blended food projects under way in other developing countries.

[7] Minister Subramaniam is also pursuing this interest at an international level; he is currently preparing a report on national nutrition strategies for the United Nations.

nence the role of the voluntary agencies. As in other countries, the motives of voluntary agencies in India—both foreign and local—sometimes were suspect. With rare exception (when accusations were made that relief food was being used for proselytization) the impressive responses of the agencies during the famine dispelled these suspicions. Planning Advisor P. K. J. Menon said in April: "If Bihar is saved, it will be the result of voluntary agency feeding programs."[9] The Prime Minister, in a meeting after the relief effort concluded, said the impact of the agencies not only convinced the Indian Government of their contribution in emergencies, but also the importance of using emergencies to attain broader developmental objectives. The significance of the voluntary agency role was perhaps best described by Verghese:

> The relief operations in Bihar have demonstrated that voluntary bodies can get things done much quicker than official agencies. The special role that voluntary bodies can play in development is as *pathfinders and pace-setters*. So many of the problems facing the country are novel and complex and cannot be tackled satisfactorily by conventional methods. There is need for experimentation and unorthodox approaches. Once established, it would be easier for Government to take over or adapt these procedures. They would be tested, proven. The other great weakness of Government is its ponderous pace of working in a jungle of red-tape. It is commonly said that something or other cannot be done in India because this is not Japan, or America or Russia, or because we are a democracy, or because there is no regimentation as in China, etc. This is a very popular brand of Indian humbug from which our governments and people suffer in equal measure. Here again, voluntary agencies can be pace-setters. They can set standards of work-performance in terms of quantity, quality, cost and time and destroy the ancient myths of what can and cannot be done in India. By doing so, they would compel governments—Central and State—to tone up their own performance and apply new yardsticks. This has already happened in Bihar (20).

IV

What, then, are the lessons to be learned from the recent India experience?

(1) The Bihar famine proved there is no substitute for strong leadership in relief operations. Some have recommended that famine assistance activities be directed via a committee of the many interested ministeries and organizations. Although coordination by committee is theoretically desirable, it is not the best forum for decision making. In a rapidly changing situation, officials must have the authority—and the willingness to use the authority[8]—to make on-the-spot decisions. There was no reluctance, for example, on the part of F. C. Gera in 1966–1967 to pick up the phone and force actions which normally take many meetings, many files and many months to achieve. The same need applies to state officials at all levels.

(2) Emerging from this experience is the realization of the need for a permanent national body to anticipate disasters, to mon-

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[8] It should be recognized there will be reluctance among some civil servants to accept unfamiliar authority. With the powers must come assurances that their careers will not be jeopardized if they make a mistake in the fast action required.

[9] Many of the major efforts were foreign: CARE alone developed a Bihar network of 27 000 school feeding centers at which children and pregnant and lactating mothers received free meals. More than twenty-four domestic agencies and business concerns established relief programs. These were brought under the umbrella coordination of the Bihar Relief Committee, directed by Jayaprakash Narayan, a former Nehru lieutenant and a major conscience figure in India.

itor them as they unfold, and then to conduct the necessary relief operations. The frequency with which disaster visits a land mass the size of India is unfortunate—but, in fact, can be anticipated. In the past, with each disaster, people in most countries awoke with surprise and began pulling together an organizational structure to begin anew. In recent years India has recognized the need and established a permanent entity.[1]

(3) A manual of relief operation can save much time in the early organization of a program. India's *Famine Code,* a thoughtful and detailed guide to local officials, was useful and surprisingly relevant, considering it had been written decades earlier.

(4) It should be noted that the Government was especially effective in conducting activities in which it had experience, e.g., standard food distribution projects and conventional work relief schemes. The record is less impressive in handling new measures such as water development programs.

(5) What foods should be provided in time of disaster? Most critical among the criteria is that the food must be available. This seems obvious. However, much time was devoted to obtaining commodities of higher nutritional value when, in fact, the greatest need was simply something to eat.[2] The food should be simple, easy to cook, and require a minimum of utensils. Fuel and water requirements must be considered. Acceptability is an important factor, even under the most traumatic conditions; therefore, if possible, the food should be familiar to the existing diet. It should have a shelf-life which can withstand the conditions of the environment it will face; it should be easily transportable under the most harrowing of circumstances; and, if possible, it should not have an attractive black market value. Finally, the selection of commodity or commodities should include nutritional considerations based on needs of the local group—which may vary considerably from one situation to another.

(6) The Bihar experience demonstrated that as a general operating rule in time of crisis, it is better to capitalize on existing institutions, rather than to build new ones. Even though the existing entity may be inefficient, energies should be devoted to grafting the necessary innovations onto them to make them work.

(7) Apropos of the above, schools proved to be the best outlet for mass distribution to both school and pre-school children, but it should be recognized that this places a burden on the education system. Classes in many areas came to a standstill.

(8) The Bihar experience proved that it is possible to design a relief effort with developmental orientation, i.e., it is possible to direct activities in a way that would help prevent the need for such relief operations in the future. Instead of the traditional "leaf-raking" programs, food and agricultural projects emerged throughout the state. Many of these were related to water development, but there is no reason why future activities could not include projects such as construction of food storage fa-

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[1] Although it is difficult to budget for disaster, one should not be taken by surprise when funds are needed. Rather than annually detract from budgets of national development programs, a country might consider the feasibility of including, as India does, a provision in the national budget for relief contingency purposes.

[2] Maximum use of fats in food preparation is recommended to help build a caloric base.

cilities and central kitchens.[3] What might have been a major disaster was, in fact, an incentive for more development in Bihar than probably took place in any other comparable period in history. There is an important psychological dimension to this. The famine, which was dramatic and created attention, was parlayed and effectively used for agricultural, nutritional and other developmental objectives. It is doubtful, even with a sufficient budget, that such activities would have taken place in the absence of the trauma created by the famine.

(9) The relief effort also clearly demonstrated the need for a communications system to provide officials with decision-making information. Trained, objective, interdisciplinary groups are essential for initial surveys, and surveillance must continue since the picture in a disaster is apt to change frequently. Although the information system described on page 119 was implemented too late to play a major role during peak need, it was used sufficiently to establish the value of a system of this nature to be included in future operations.

(10) Another information requirement is a program designed to keep the general public apprised of what is happening and what facilities and programs are available to them. There is a significant psychological dimension to waiting out a disaster. Just knowing of official efforts to cope with the problem is important.

(11) Although the famine dramatized the significance of voluntary agencies, such organizations vary in their capability. It became clear that it is best to channel resources through established voluntary agencies rather than through organizations which emerge for the purpose of helping in the disaster. For example, CARE, the largest and most successful program, conducted most of its activities through the school system, an administrative mechanism with which it had intimate experience. The religious agencies worked best where resident missionaries were able to build on years of familiarity with local habits and confidence of the local people. For certain other of the agencies, there is question whether their eventual contribution justified the time of the busy, often harrassed, government officials who were required to deal with them. It might also be noted that although there was reasonably good cooperation among the many agencies in the field, cooperation was not synonomous with coordination. There were well intentioned efforts to sort out the many activities and make maximum use of the limited resources, but it was a rare district officer who could impart a sense of order. In general, the operations worked only because there was so much to be done in so many places that there was little room for conflict or overlap. In any subsequent relief operation there would be room for improved central coordination, and governments should give thought to direct assignments to the voluntary agencies. These groups could be made responsible for a particular type of project—feeding, public works, water, health—and projects further specified by geographic area and age group.

(12) For foreign assistance agencies attempting to help local governments in time of disaster, certain points also emerged from this experience. The major need is for

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[3] This point needs qualification: Heavy manual labor schemes should *not* be encouraged when available food supplies are inadequate. Although the dole concept runs against the grain of fundamental principles of development, it may be preferable to burning up energy when calories are in extremely limited supply.

the delegation of adequate authority to make required decisions in the field. Time is critical and the usual delays of intercontinental communication dilute effectiveness. It should also be recognized that an agency can be severely handicapped by lack of adequate personnel. This seems obvious, but from afar it is difficult to know the man-hour requirements for rerouting ships, for transferring food, and for the amount of necessary paper work entailed in an operation of this magnitude. In sustained emergencies, efficient, experienced staffing should receive highest priority.

(13) The crisis conditions under which relief is carried out require reevaluation of standards and values. Resources are inadequate. Inefficiencies exist. Graft and profiteering are common in disasters throughout history. The need is to recognize the reality and try to strike a balance of reasonable efficiency, productive use of limited resources and social justice, even if it means letting the latter slip a bit to get things done.

(14) Nutritionally, two studies of the Bihar famine (21), while noting serious deficiencies, also pointed to surprisingly good nutrition levels, resulting undoubtedly from the relief programs. Local observers recognized a resiliency among the Indian peasants which defied all medical calculation. Standard statistical health measures apparently are no basis for anticipating conditions there. Professor Ramalingaswami's paper at this symposium will provide details of the medical findings.

(15) Finally, it was seen that for all the many difficulties, democratic institutions can respond quickly enough and with sufficient force to meet this kind of crisis. Some observers had recommended greater involvement by the army or a complete takeover by the federal government. But local officials, splendidly supported by Delhi, responded more effectively than anyone had envisioned. By any measure, it was a remarkable achievement.[4] Help came from many sources but, in the final analysis, the victory clearly was that of the Government of India and the local officials.

Verghese, in 1967, wrote: "The Famine has been a revelation, a trial, a shame; but also an opportunity and an awakening. It has transformed some of the inertia of the past into energy" (22).

In 1969, parts of Bihar had reverted to old form. Some of the inertia had returned and the delays and sluggishness in project implementation again became part of daily life. But, also, much had changed. In the year following the drought, Bihar's food grain production achieved an all-time high, nearly double that of the drought year, and a 7.6% increase over the last pre-drought year. In 1968–1969, production increased

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[4] The energetic official response to the famine compensated for the more modest response from the Indian public. The Prime Minister in early November said to newsmen she was distressed that while some places in the country were in the grip of unprecedented drought and scarcity, incidents were taking place elsewhere "which showed utter callousness of the people" (Indian Express News Service, November 6, 1966). In a national appeal, Mrs Gandhi called for a "war on drought" and established a Prime Minister's Drought Relief Fund. The collection after the first year totaled $2.2 million. This compares to a public contribution eight times as great for the Prime Minister's Fund for National Defense which resulted from the brief war with Pakistan in 1965.

by another 10.5%.[5] Although Bihar was still one of the least developed of Indian states, there were improvements of land, of body and of frame of mind. As one Bihari official said, "things can never be the same".

One has difficulty avoiding the obvious comparison of the relief effort during the Bihar famine to that of the Bengal famine a quarter of a century earlier. As suggested at the outset, there were, of course, significant differences. Yet, according to former Food Secretary A. L. Dias (23), "Even discounting the formidable difficulties which confronted Government at that time (1943), I have come to the clear conclusion that the loss of millions of lives was clearly avoidable. Bihar in 1967 was, in fact, the answer."

The author is indebted to Indian officials C. Subramaniam, former Minister of Food and Agriculture; A. L. Dias, former Secretary of Food, F. C. Gera, former Joint Secretary charged with coordinating scarcity relief; and George Verghese, former Information Advisor to the Prime Minister; and also to Philip Harvey, former Deputy Director of CARE/India, all of whose thoughts and time have been leaned upon heavily in the preparation of this paper. Appreciation is also expressed to the officials of the 1966–1967 U.S. Drought Relief Committee, whose ideas and actions are, in part, reflected in the experiences described here.

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[5] This was part of the larger national food production surge resulting from the new agricultural strategy. In the two years following the famine, acreage under high yielding varieties had increased five fold. Fertilizer consumption more than doubled, and perhaps of greater significance, so did the production of local fertilizer. More new land came under minor irrigation than during the previous five years. The number of tractors increased in one year from a previous cumulative total of 51 000 units to 81 000; half of the new tractors being locally produced. Food grain production reached 95 million tons. Special note should be made of the contribution in all of this of the new producer-oriented price policies.

tories (see "Food and situation in the drought affected areas of Bihar", by M. C. Swaminathan, K. V. Rao and D. H. Rao, (Indian) *Journal of Nutrition and Dietetics*, no. 6, 1969, pp. 209–217); the other by the All India Institute of Medical Sciences, conducted by Dr V. Ramalingaswami and colleagues (unpublished).

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NUTRITION AND RELIEF OPERATIONS—THE NIGERIAN EXPERIENCE

by Dr A. Omololu[1]

The Nigerian Civil War started in July 1967 and lasted 30 months in all. At the beginning (1967), there were four regions in the country:

The Northern Region (pop. 30 million),
The Eastern Region (pop. 12 $^1/_2$ million),
The Western Region, incl. Lagos (pop. 11 $^1/_2$ million),
Mid-West Region (pop. 2 $^1/_2$ million).

The civil war was between the Eastern Region and the rest of the country. The troubles that led up to the civil war started in January 1966 with an Army Coup and through 1966 and early 1967, the country was unsettled.

The Eastern Region which was the seat of the rebellion, comprised many tribes—the Ibos, Ibibios, Anangs, Efiks etc. Since the formation of States by the Federal government in 1968, the old Eastern Region has been divided into three states—the East-Central, Rivers and South-Eastern States. Fig. 1 is a map of Nigeria showing the three states that made up the old Eastern Region. Just before the civil war started, there was a call from the leaders of the region that all people of the region in the other parts of the country should return home. It is estimated that about 3 million people—again comprising Ibos, Ibibios, Efiks and others—returned at this time. Thus, at the beginning of the war, about 15 million people were in the region—12 million residents and 3 million who had left their homes and jobs to return home.

The Federal Military Government, in a bid to prevent the civil war, enforced a blockade on the Eastern Region. This blockade continued when the war broke out as a measure to curtail the war. The aims of this blockade were two-fold. One was to paralyse trade so that goods, raw materials etc. could not get into the region from outside the country thereby causing a collapse of the economy. The second aim was to prevent inter-regional movement of goods and money which would have made nonsense of the blockade.

An indirect effect of this blockade was on food supply in the region. Nigeria, as a country, produces enough of its staple foods and diets to be almost self-sufficient nutritionally. This self-sufficiency is, however, dependent on inter-regional movement of food items. The diet of the people of the Eastern region (ICNND, 1967; EKPO, 1966) Oluwasanmi et al., 1966) comprised foods from other regions of the country and from outside the country—meat, ground-nuts, beans, other cereals and groundnut oil from the Nothern Region; yams and beans from the middle belt area of the country; fresh and smoked fish from the sea through the Rivers and South Eastern states and stockfish, salt and milk from outside the country (Fig. 2).

It will be apparent that the list of food items that must needs be imported into the

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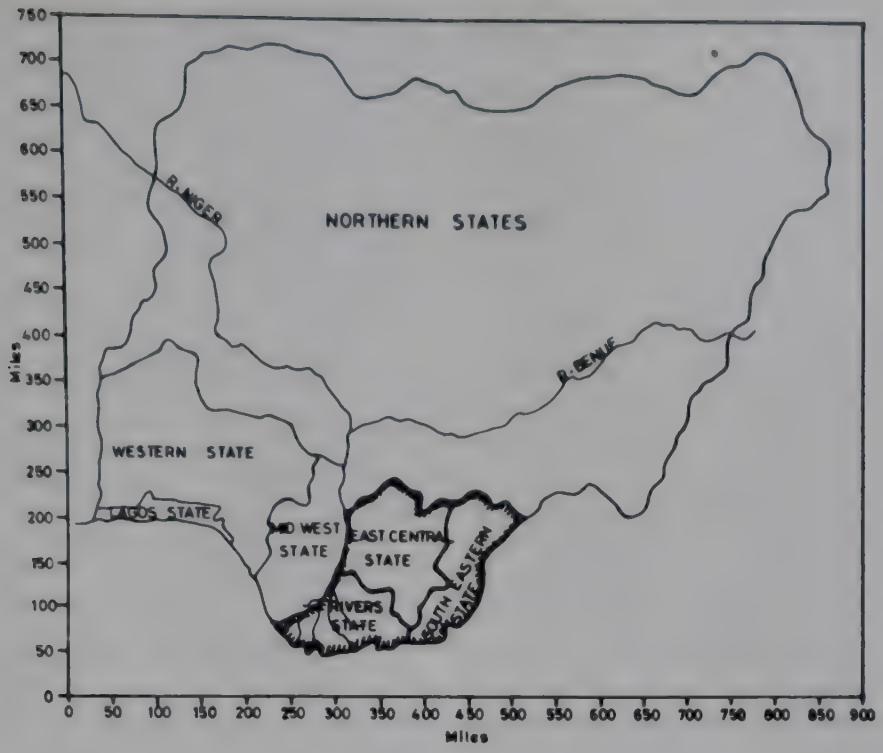

Fig. 1.

then Eastern Region, comprised the bulk of protein in the diet, especially animal proteins. Omololu (1969) has shown that the average daily intakes in the area of these food items before the civil war were as shown in Table 1, for the East Central, South Eastern and Rivers States.

Thus, for the duration of the civil war, the overgrown population of the region had to live without most of its protein food. It is therefore not surprising that malnutrition was rampant.

Relief

During the war, the Federal Military Government allowed some relief flights into the

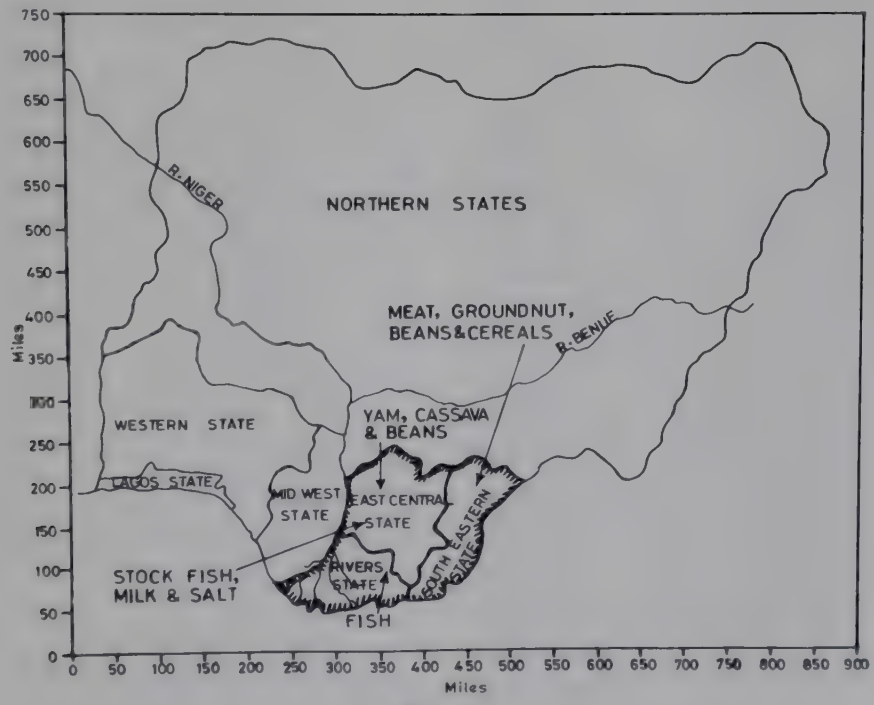

Fig. 2.

TABLE 1. *Average daily intake in grams (Adapted).*

	East Central	South-East	Rivers
Fish	22	15	22.4
Meat and meat products	13	3	12.3
Beans	26	8	20
Groundnuts	2	—	1

region. Unfortunately, the rebels did not allow relief materials and food to be brought in by ships so that the amounts that entered the region by air was small.

The present paper does not discuss the nutritional state or relief work in the rebel areas during the fighting. The paper concentrates on the problems as well as the relief work in the South Eastern and Rivers States from August 1968—when most of the area had been liberated—till the present.

The problems in these two states were complicated in that the main people in the two states were not Ibos; most of them, though in the Eastern Region, were against secession. As such, the leaders and army of the rebels had to treat the areas as "occupied territory". The main source of animal protein in the diet of the two states was fish (Table 1) and the men were mostly fishermen. The rebels could not trust them to go out fishing, for fear of desertion to the Federal troops. Fishing was banned in both states. Thus, not only the main source of protein but also the main source of money of the population of the two states, was stopped. The small amount of relief materials that came into the rebel enclave landed in Ibo territory and never found its way to the people of either state. To make matters worse, the rebel army in the two states extracted food from the farmers and villages. These facts made the nutritional state of the populace in both South-East and Rivers states very bad at the time of liberation of the two states. Previous to the liberation of the two states in 1968–1969, the rebel troops resorted to indiscriminate removal of essential equipment and people that could be of use to the Federal troops. All hospitals were looted—drugs, beds, transport, operating tables, as well as doctors, matrons, pharmacists and nurses were moved back to what was left of the rebel area. All motor cars, lorries and other means of transport were removed, destroyed or immobilised; public offices had all furniture, files and stores burnt; all professionals including engineers were also abducted.

It will be apparent from the above, that for these two states—the South-Eastern and Rivers States—the main aims of relief action should have been

(*a*) Food for *everyone*—to correct the malnutrition that resulted from the occupation of the area.

(*b*) Plans to get the people back to their homes and farms; transport.

(*c*) Arrangements—food, etc.—for the people who lived in the area where fighting was still going on, to tide them over the period of fighting and to get them back to their farms and homes as soon as possible.

(*d*) Medical care for everyone by the medical teams—as the people had been short of medical care and drugs for the duration of the war.

(*e*) Aid to the States' ministries of Health to reopen, equip and staff hospitals: to the ministries of Education, to reopen and staff shoools: to the Ministries of Social and Community Welfare to look after abandoned children and orphans, rebuild houses, bridges and roads, rehabilitate and resettle people on their farms and in their work.

At a seminar run by the Nutrition Society of Nigeria in November 1968, these facts were high-lighted by the members—who offered their services for relief work. Unfortunately, the Co-ordinator of the International Committee of the Red Cross (ICRC)—which was in charge of relief work in the country at that time—could not attend the seminar. Previous to this, in August 1968, UNICEF and other UN agencies interested in relief work in Nigeria, called together a group of nutritionists—both Nigerians and others with experience of Nigeria and Africa—to advise on relief work. It was not possible to obtain from the ICRC and other relief agencies, such foods as were then being used for relief and, more importantly, the numbers of people at risk. This group of nutritionists was, however, able to prepare a document "Notes on diets for Displaced and Needy persons and the treatment of Malnutrition"—attached as Appendix to this paper. The document showed which foods would be acceptable to the people of the area, the amounts that would be needed by different age groups, pregnant and nursing women, local measurements, amounts to be used when two or more foods are given out and nutritionally acceptable foods. Thus from the document, amounts and types of foods to be ordered could be worked out by relief agencies, once the numbers of people at risk were known. The document could be used by workers in the field for food distribution and also for field treatment of kwashiorkor.

Most of the comments that follow highlight the defects in the relief and rehabilitation work of the ICRC in Nigeria. This is because the ICRC was the main agency in charge of relief and aid in Nigeria from 1968 till 1969. It is important, however, to record the admirable work done by the ICRC and its teams under very trying conditions. The ICRC started its work in Nigeria backed and motivated by lots of overseas sentimental propaganda and no actual experience or facts to direct its activities. It seems, in retrospect, that the ICRC was convinced that no Nigerian nor the Federal Government could help or give advice on its relief work in Nigera. This attitude resulted in unsuitable foods like tinned rice puddings, custards, potato chips etc. being used for relief—and the displaced people refusing them.

Again, the different national teams that comprised the ICRC included school boys, gatemen, mechanics and even a few undesirables. The medical teams were made up of one—or two—doctors, but mostly of nurses and auxiliaries, most of whom had had no idea of tropical medicine or malnutrition. These were the people who were expected to find out, treat and manage kwashiorkor, marasmus, scabies, measles, and other conditions—as well as report on the socio-economic plight of Nigerians!

Their reports of numbers and diseases were naturally outrageously wrong—but these were the figures that were flashed all over the world by the press and the ICRC. Again, these national teams—Germans, Swedes, British as well as the Quakers, Save the Children Fund, and many others—were only responsible to their national councils at home and *not* to the ICRC coordinator in Nigeria. They came and went as directed by their national councils and not by the needs of the ICRC. There could only be very little coordination of their activities by the ICRC. Often, when one national team left, teams from other nations refused to continue their work! Most of the teams came for very short periods—3 months and very rarely 6 months. They arrived with no knowledge of malnutrition or disease in Af-

rica, and left just as they were settling down to learn.

To correct some of these anomalies, the Federal Military Government late in 1969, had to insist that the ICRC hand over the coordination, planning and running of relief work in the country to the Nigeria Red Cross. Early this year (1970), a National Rehabilitation Commission was formed under the Ministry of Economic Planning and Rehabilitation, to coordinate relief and rehabilitation work for the whole country. Each state has its own Rehabilitation Commission, responsible for planning and effecting relief and rehabilitation in the state and it is through these State Rehabilitation Commissions that the National Rehabilitation Commission carries out its work in each State. (We also have over 2 million Nigerians sent out of Ghana in the past 6 months to rehabilitate and settle).

The lessons that can be learnt from the Nigerian Civil War are many. They include the following;

1. International Relief Agencies *must* work *with* local medical and non-medical nutritionists so as to get local knowledge of food habits, staple and acceptable foods, to learn about local conditions, likes and dislikes and to make good use of its available funds and resources.

It will be helpful, if these agencies could prepare a list or panel of advisers from different countries who could be called upon to help whenever questions of relief arise in their countries.

2. Medical and non-medical teams brought from outside a country for relief work should be allowed to have a week or two of orientation and training—to learn about disease patterns, habits and socio-economic problems of the people—before being put in the field. This may mean that teams should be made up of people who were ready to serve for more than three months.

3. Relief work should begin only after an appraisal of the situation by a team of regional experts—from the advisory panel suggested above—who would work out a plan of action. Evaluation of the relief work should be carried out from time to time to see that the plan is followed or modified. The plan should include advice about local foods, acceptable foods and local measurements (see appendix) thereby aiding the central agency in asking countries for aid and the foods and articles to ask for.

Each country or region, should be encouraged to develop its own team of experts to work out plans to be used for common types of disasters and prepare manuals for types of foods etc.

4. TRANSPORT and logistics are always very important in relief work. In Nigeria, we had the experience of each donor country sending its own makes of lorries, vans and cars without spares, tools etc. As soon as a fault developed in these vehicles, repairs became impossible.

It should be possible for agreement to be reached on four or five makes of vehicles to be used for international relief work—the main international agency carrying a stock of spare parts for these cars. On the other hand, it may be agreed at the beginning of each relief operation to use only one or two makes of vehicles. Another make could be used for the next relief operation, thus affording each country an opportunity for its vehicles to be used.

5. Effective relief should merge imperceptibly into rehabilitation and settlement—as such it is imperative that International Relief agencies should always work with governments and not antagonise them. In Nigeria, we saw International Relief Agencies sometimes motivated and supported by

propaganda, an ill-informed press looking for sensation and by a cleverly cultivated world sentiment trying to work against the wishes of a government and its people. This should never be. Planning and running of relief should be based on facts—not sentiments or bought propaganda. Relief agencies must work with governments and government ministries to do the most good, to the most needy people in the shortest possible time and at the least cost in money, materials and men.

6. In developing countries, where the individual responsibilities to families and the extended family are still very strong, the present practice of relief agencies and workers trying to concentrate on children or women defeats its own ends. Sometimes, foods are given to children only—at home, because of shortages—it is shared among the extended family. Thought should be given to the idea of issuing bulk food for families rather than giving food for individuals—because the individual cannot use the food in his or her family without sharing.

In conclusion, one would like again to place on record, the great debt of the people of Nigeria to the International Committee of the Red Cross, the UN agencies, the national committees of Red Cross and all the other agencies that carried out relief operations in the country.

Summary

The shortage of food resulting in mass famine and starvation in the rebel held areas during the Nigerian Civil War was caused mostly by the restriction on the movement of animal protein foods and staple diet from other parts of Nigeria enforced by the Federal Government of Nigeria in a bid to prevent and shorten the civil war. The mass movement of an estimated 3 million people into the rebel area just before the civil war started increased the food shortage.

As soon as certain parts of the South-Eastern and Rivers States were liberated in 1968, the International Committee of the Red Cross, the UN agencies and the Nigerian Red Cross started a massive relief operation in these areas. The difficulties encountered included amongst others, the indiscriminate mass movement of local population, the use of personnel not conversant with the health problems of the area, the hard terrain and mode of military action as well as the lack of coordination between the national teams that made up the International Committee of the Red Cross.

The lessons learnt from the work of the International Committee of the Red Cross, the UN agencies, the Nigerian Red Cross and the Nigerian Rehabilitation Commission are stated and recommendations based on field work in the areas are made.

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NOTES ON DIETS FOR DISPLACED AND NEEDY PERSONS AND THE TREATMENT OF MALNUTRITION

Prepared for the use of Personnel engaged in Relief Feeding and the Agencies assisting them.

AUGUST 1968

Contents

Introduction and use of tables
Treatment of Protein-calorie malnutrition
Diets for those 13 years and over
Diets for those 6 years to under 13 years
Diets for those 2 years to under 6 years
Diets for those 0 years to under 2 years
Rough volume Measures

INTRODUCTION

Purpose

The purpose of these notes and tables is to provide, as simply as possible, a single diet list which can be used equally well by those concerned with bulk ordering, for bulk distribution, and by those responsible for final distribution in the field. It is hoped that this will ensure that supplies will arrive at the distribution points in approximately the proportions they are required.

Addresses for questions

These notes have been prepared at the request of the UNICEF Executive Director by:

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Dr H. J. L. Burgess, WHO Nutrition Consultant.

The first three of the above are available in Nigeria to answer any queries about these notes or to answer any other nutritional questions.

Choice of foods

The foods used in the accompanying table include those likely to be available locally or purchased within Nigeria by the Government and agencies concerned, and secondly foods provided or likely to be provided from outside sources.

Some explanation of the terms used in the table is necessary. In the list, foods unfamiliar to the local population and which therefore may pose problems of acceptability and preparation have been placed in brackets:

Cereal = maize, rice, (bulgar wheat, rolled oats) whole grain as opposed to flour is preferred.
Fresh roots = yams, Cocoyam, cassava (potatoes).
Gari – domestically prepared from cassava.
Oil = any edible oil but red palm oil is preferred and should be available as it is a local industry.
Dried fish = dried stock fish—locally popular.
Whole egg = unlikely to be available in large quantities.
(Dried egg)—availability uncertain.
Dried skim milk—unfamiliar but likely to be acceptable, teach how to mix into food rather than reconstitute.
Corned beef—unfamiliar but likely to be acceptable.
Canned fish—unfamiliar but likely to be acceptable. Calculations based on the Nigerian produced fish in oil.
(CSM) = corn, soya, milk mixture. Resembles a yellow maize flour, probably only acceptable for children. 1 part CSM to 4 parts water + 5 minutes boiling makes a thin pap. Stiffer mixtures can be made or the CSM mixed with other food.
Cowpea/bean = cowpeas and any other commonly used local bean.
(Groundnuts)—locally eaten whole as a snack. For children it should be crushed and used in side dish.

Salt—not included in calculations but should be provided (5 g/head/day).

Recipients of the above foods should be encouraged to make as much use as possible of local leafy vegetables and fruits in order to augment their vitamin supply.

Use of the tables

The tables have been designed so that a staple with oil, plus the quantity of a single supplement shown against it will provide an adequate diet for 24 hours, e.g. cereal 500 g + oil 40 g + dried fish 25 g is sufficient for an adult for one day.

Quantities for four age groups are provided "13 years and over", "6 to under 13 years", "2 to under 6 years", and "0 to under 2 years" plus extras for pregnant and lactating women and for children deprived of breast milk. This allows bulk and individual calculations to meet the needs of the kind of population served with any combination of foodstuffs.

Where more than a single staple and supplement are available, and this is highly desirable, quantities can be calculated on a simple proportional basis. Thus if one staple and two supplements are available give 50% of the quantity of each supplement matching that staple (or 25% and 75% or any proportion desired), e.g. for an adult:

$$\text{Cereal 500 g} + \text{oil 40 g} + \begin{cases}\text{canned fish 20 g}\\ \text{cowpeas 40 g}\end{cases}$$

Similarly if two staples are available the proportion of each staple issued should be matched by the same proportion of supplement corresponding to each staple, e.g. for an adult:

$$\left.\begin{matrix}\text{cereal 250 g}\\ \text{fresh root 800 g}\end{matrix}\right\} + \text{oil 40 g} + \begin{cases}\text{canned fish 20}\\ \text{canned fish 45/65}\end{cases}$$

or

$$\left.\begin{matrix}\text{cereal 250 g}\\ \text{fresh root 800 g}\end{matrix}\right\} + \text{oil 40 g} + \begin{cases}\text{cowpeas 40 g}\\ \text{corned beef 42 g}\end{cases} \quad (41.5)$$

The poor food value of fresh roots and gari shown in the tables should be noted. Except for those over 12 years it has not been possible to construct a diet with them as the only staple. For the youngest age group they could not be used as the staple at all.

Convenient measures

While weights expressed in grams are necessary for all bulk calculations they are of little help at the point of final distribution to the people.

For this reason a table of volume measures has been added which will enable personnel to select suitable containers for issuing the particular diet variation they are using (Table 5).

Using any reasonably accurate scale additions to this table can easily be made to suit particular circumstances and containers. Conversion from ounces to grams etc. are also given in the table.

Diets for Treatment of Children with Protein-calorie Malnutrition

(Kwashiorkor and Marasmus)

Recipes for two pints of each diet (dsp. = dessert spoon heaped to same convexity as spoon bowl).

1. *Reinforced skim milk:* Suitable for all but *very* severe cases or those with persistent diarrhoea.

	Ounces	Volume measures	Nutrients
Dried skim milk	4¼	9 dsp.	Protein 43 g
Sugar	1	2 dsp.	Calories 863
Oil	1¼	5 dsp. (1½ fl. oz.)	
Water		35 fl. oz. (or make up to 2 pints)	

2. *Casilan skim milk:* Reserve for the severest cases as it is expensive.

	Ounces	Volume measures	Nutrients
Casilan	1¼	8 dsp.	Protein 44 g
Dried skim milk	1¼	3 dsp.	Calories 1028
Sugar	1¼	2 dsp.	
Oil	2½	9 dsp. (3 fl. oz.)	
Water		35 fl. oz. (or make up to 2 pints)	

Preparation

(*a*) Mix together the Casilan (if used), dried milk and sugar in the quantities needed.

(*b*) Stir in the correct amount of oil and mix well. (Red palm oil if used is more difficult to mix, addition of an egg helps but is not essential.)

(*c*) *Slowly* add enough *cooled* boiled water to make up correct volume, stirring well all the time. (If there are any lumps, strain, and mix lumps with a little of the strained milk.)

(*d*) Store in a cool place in a covered container. Do not keep for more than 4–6 hours unless stored in a refrigerator.

Dosage

Total of 2–2 $^{1}/_{2}$ fluid ounces per pound body weight a day, given in divided doses 6–8 times per day or approximately:

Child less than 10 lbs weight	1 pint per day
Child 10–20 lbs. weight	2 pints per day
Child 20–30 lbs. weight	3 pints per day

The above regime provides all the necessary protein and calories for the child. Other foods should be introduced as soon as recovery starts, provide these only *after* the child has finished the milk. If bulk is a problem some of the dry milk mixture can be mixed into this food provided it is eaten.

As the malnourished child's store of vitamins is likely to be low give extra vitamins until he is eating other foods in normal amounts (especially vit. B complex, vit. C and vit. A if red palm oil not being used).

Severely sick children with diarrhoea can have the feeds diluted by half, then raised gradually to full strength as quickly as possible. On no account should only glucose and water be given as this will be rapidly fatal.

Administration

Where the child is too anorexic to take all the milk vountarily by mouth give intra-gastric feeds. Polythene tubing, internal diameter 1 mm, length 21 inches (55 cm) can be left *in situ* for a week or longer. Feeds can then be slowly dripped in using an old blood giving set, the bottle being changed every 4 hours to prevent the milk souring. A syringe can also be used to give the feed but this must be done slowly (a size 18 B.W.G. needle fits the tubing).

General care

Malnourished children are liable to hypothermia. They must be kept warm. The easiest way is to let them sleep with their mothers.

Rarely keep a malnourished child in bed. He is happier and less liable to hypostatic pneumonia if sitting on mother's lap, or if not tube fed is carried on her back.

Parents or guardians must be taught the foods the child needs after discharge as they will have to complete the treatment and prevent relapse.

Accompanying illnesses such as malaria, anaemia, worms and infections must be treated. The poor resistance of a malnourished child often justifies prophylactic antibiotics and antimalarials where careful nursing supervision is not available.

Electrolytes

Malnourished children especially those with diarrhoea and vomiting frequently lack electrolytes. Therefore, for those dependant entirely on the milk diet 15 mls. ($^{1}/_{2}$ fl. oz.) of electrolyte solution can be added to each pint of the milk. To prepare a suitable solution add 90 g potassium chloride plus 9 g magnesium hydroxide to 100 ml (1 litre) of water.

TABLE 1

Age group 13 years and older, quantities/head/24 hours

Calorie range 2 200–2 300 approx.; protein range 45–60 g; net dietary protein calories 6.0 % except with groundnut supplement (5.4) which is low but tolerable for adults

Staple (g)				Staple (g)				Staple (g)				
Cereal	Oil	Supplement (g)		Fresh root	Oil	Supplement (g)		Gari	Cereal	Oil	Supplement (g)	
500	40	Dried fish	25	1 600	40	Dried fish	25	300	200	30	Dried fish	30
500	40	Whole egg	80	1 600	40	Whole egg	100	300	200	30	Whole egg	113
500	40	Dried egg	22	1 600	40	Dried egg	28	300	200	30	Dried egg	31
500	40	Dried skim milk	25	1 600	40	Dried skim milk	53	300	200	30	Dried skim milk	60
500	40	Corned beef	35	1 600	40	Corned beef	83	300	200	30	Corned beef	94
500	40	Canned fish	40	1 600	40	Canned fish	90	300	200	30	Canned fish	103
400	40	CSM	150	900	40	CSM	200	300	0	30	CSM	250
450	40	Cowpea/bean	80	1 300	40	Cowpea/bean	150	250	250	30	Cowpea/bean	150
450	40	Groundnuts	80	1 000	40	Groundnuts	200	150	250	30	Groundnuts	150

Pregnant and lactating women should be provided with 1/5 (20 %) *extra* in addition to the above ration. Because of their large bulk fresh roots should preferably not be used to provide this 20 % extra.

The quantities given above are only sufficient for "light work". Hard physical labour needs an increase of both staple *and supplement* by up to one third. Protein quantities are minimal so increase of staple alone would lower the value of the diet.

Where cuts in the ration have to be made for short periods due to lack of supplies etc. as far as possible such reductions should only be made in the staple.

TABLE 2

Age group 6 to under 13 years, quantities/head/24 hours

Calorie range 1 700–2 000; protein range 35–50 g; net dietary protein calories 6.0 %

Staple (g)				Staple (g)				Staple (g)				
Cereal	Oil	Supplement (g)		Fresh root	Cereal	Oil	Supplement (g)		Gari	Cereal	Oil	Supplement (g)	
400	40	Dried fish	25	800	150	30	Dried fish	15	300	100	30	Dried fish	30
400	40	Whole egg	70	800	150	30	Whole egg	55	300	100	30	Whole egg	113
400	40	Dried egg	20	800	150	30	Dried egg	15	300	100	30	Dried egg	31
400	40	Dried skim milk	25	800	150	30	Dried skim milk	29	300	100	30	Dried skim milk	60
400	40	Corned beef	35	800	150	30	Corned beef	46	300	100	30	Corned beef	94
400	40	Canned fish	40	800	150	30	Canned fish	50	300	100	30	Canned fish	103
300	40	CSM	150	800	0	30	CSM	160	300	0	30	CSM	200
350	40	Cowpea/bean	80	800	150	30	Cowpea/bean	65	200	200	30	Cowpea/bean	120
350	40	Groundnuts	70	800	150	30	Groundnuts	75	Groundnuts unsuitable supplement for gari				

Where cuts in the ration have to be made for short periods due to lack of supplies etc., such reductions should, as far as possible only be made in the staple.

For children already showing evidence of malnutrition extra supplement (50–100 %) preferably of animal origin food should be given.

The quantities given above are only means for the age group. The younger children may therefore want less staple but their supplements should be reduced.

TABLE 3

Age group 2 to under 6 years, quantities/head/24 hours

Calorie range 1 200–1 400; protein range 30–40 g; net dietary protein calories 6.5 % or over

Staple (g)				Staple (g)				Staple (g)				
Cereal	Oil	Supplement (g)		Fresh root	Cereal	Oil	Supplement (g)		Gari	Cereal	Oil	Supplement (g)	
250	30	Dried fish	25	400	150	20	Dried fish	11	150	150	20	Dried fish	20
250	30	Whole egg	50	400	150	20	Whole egg	40	150	150	20	Whole egg	70
250	30	Dried egg	15	400	150	20	Dried egg	11	150	150	20	Dried egg	20
250	30	Dried skim milk	25	400	150	20	Dried skim milk	21	150	150	20	Dried skim milk	40
250	30	Corned beef	35	400	150	20	Corned beef	33	150	150	20	Corned beef	63
250	30	Canned fish	40	400	150	20	Canned fish	36	150	150	20	Canned fish	69
120	30	CSM	150	400	0	20	CSM	150	130	0	20	CSM	200
200	30	Cowpea/bean	80	400	150	20	Cowpea/bean	55	Cowpea/beans/groundnuts cannot adequately supplement this diet				
200	30	D.S.M. 15 + groundnut	70	Groundnuts unsuitable supplement for this diet									

Groundnuts and beans must be pounded or mashed for this age group.

For this age group, the diet above provide just sufficient protein and calories, no reduction should occur.

Staples particularly roots or gari, must not be increased without corresponding increase in supplements.

This group is very vulnerable to protein-calorie malnutrition. If they are already malnourished the supplement ration should be doubled preferably using the low bulk foods from animal source.

If more severely malnourished see the separate notes on treatment of protein-calorie malnutirtion, refer such cases to a medical unit where possible.

TABLE 4

Age group 0 to under 2 years, quantities/head/2 hours

Calorie range 780–900; protein range 20–30 g; net dietary protein calories 7.5 % or over

Staple (g)					
Cereal	Oil	Supplement (g)			
150	20	Dried fish	25	An adequate diet based on fresh roots cannot be constructed for this age group. Fresh roots can be given as a snack in addition to a diet based on cereal + supplement. However, if more than a few grams are eaten, extra supplement (+25 % to 50 %) should be given.	An adequate diet based on gari cannot be constructed for this age group. If used at all the same instruction apply as for fresh roots.
150	20	Whole egg	50		
150	20	Dried egg	15		
150	20	Dried skim milk	25		
150	20	Corned beef	35		
150	20	Canned fish	40		
0	20	CSM	150		
130	20	Cowpea/bean	70		
100	20	D.S.M. 25 + groundnut	50		

Groundnuts and beans must be pounded or mashed for this age group. For the smaller children the other supplements such as fish should also be rendered soft and bone free.

Children breast fed by a reasonably healthy mother do not normally need other food until 4–5 months of age. Children who have been deprived of breast milk should receive extra supplement (50 % to 100 % extra according to age). The supplement most suitable for the capabilities of the child should be given.

For very young children deprived of breast milk use the dried skim milk–oil–sugar mixture described in the notes on treatment. As this is low in vitamins small quantities of other foods should also be given.

TABLE 5

Rough volume measures for use in issuing foods

All measurements are with the container filled level. If desired the quantity in spoon measures can be doubled by heaping to a convexity equivalent to that of the bowl of the spoon

Measures	Approx. weight (g) of food held by container (level)							
Elastoplast adhesive bandage 3 inch tin	Cereals (whole grain)	220	Gari	180	Dried skim milk	160	CSM	160
	Cowpeas	210	Groundnuts	180				
Elastoplast adhesive bandage 2 inch tin	Cereals (whole grain)	150	Gari	120	Dried skim milk	110	CSM	110
	Cowpeas	140	Groundnuts	120				
Small peak milk tin	Cereals (whole grain)	130	Gari	110	Dried skim milk	90	CSM	90
	Cowpeas	120	Groundnuts	110				
Aluminium small market bowl — 4 inch diameter mouth ("Roboto") in Yoruba	Cereals (whole grain)	200	Gari	150	Dried skim milk	130	CSM	130
	Cowpeas	170	Groundnuts	150				
Large market spoon, bowl 3 3/4 inch long	Dry skim milk	15	CSM	15	Oil	10		
Table spoon	Dry skim milk	7	CSM	7	Oil	12		
Dessert spoon	Oil	8						
Large beer bottle (31 oz.)	Oil	585						
1 tin corned beef	Weight stated on tin. Crescent corned beef contain 170 g							

Other useful measures:

One whole hens egg (local size) = 50 g approx. Dried fish portion size of one large match box = 15 g. Average size yam root weight 2.27 kilos (5 lbs.). 1 ounce = 28.4 g. 1 kilogram = 2.2 lbs. 1 pint = 568 mls.

RECENT FIELD EXPERIENCES IN EASTERN NIGERIA (BIAFRA)

by Aaron E. Ifekwunigwe[1]

The experiences described were derived from working in various programmes of Public Health in general and for the children in particular, both inside and outside hospitals, for the past four years in the war-affected areas of Eastern Nigeria (Biafra) before, during, and after the war. The problems presented by protein-calorie malnutrition (PCM) were probably unique in that, as a result of the hostilities, there was a sudden outbreak in "epidemic" proportions of PCM in an area where it previously did not constitute a major Public Health problem. Cases occurred in hundreds of thousands in a situation where initially there was no provision for coping with them.

These experiences will best be discussed in four parts as follows:

A. Some noteworthy clinical features of PCM

B. Organization of medical and nutritional services

C. Mass immunization programmes against measles, smallpox, and tuberculosis in a war situation

D. Several high protein preparations utilized

Historical and Geographical Background of PCM in this area

Before the war, PCM was not a major problem in Eastern Nigeria. Most of the observed cases were those secondary to chronic illnesses, especially tuberculosis. The widespread prevalence of primary PCM (or PCM due to deprivation of essential foods) was certainly a direct consequence of the war and its antecedent events. Under normal conditions, a proportion of the protein-rich foods came from the cattle-raising Northern region, but there were enough carbohydrate foods available locally such as yams and cassava. Furthermore, the main food-producing areas were located at the periphery of the region and subsidized the central more densely populated areas.

When hostilities broke out in July, 1967, the supply of protein rich foods was greatly reduced right from the onset, and the population relied on goats, sheep and chickens, but these in time were exhausted. As a result of the war, there was a large movement of population away from their homes, farms or places of trade towards the centre of the country where they became refugees.

The first cases of primary PCM were noticed at the beginning of 1967 amongst the children of refugees from other parts of Nigeria, who returned home some three months earlier, because of the disturbances of May through September, 1966. The numbers remained small until the beginning of 1968 when cases occurred in "epidemic" proportions, though the early signs had been noticed in a large number of children in November, 1967. The period May through November, 1968, was particularly bad and tens of thousands of children must

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TABLE 1. *Clinical types of PCM in children seen at various periods of the crisis (from 5000 cases).*

Period	Kwashiorkor predominantly (%)	Marasmus predominantly (%)
March 1968	92	8
December 1968	77	23
June 1969	56	44
September 1969	36	64
January 1970	21	79
June 1970	34	66

have died. During the later stages of the war, sources of carbohydrate foods became exhausted, in addition to the pre-existing protein shortage. Thus, the clinical picture of PCM which was predominantly kwashiorkor became predominantly marasmus.

A. Some noteworthy Clinical Features of PCM

Protein-calorie malnutrition has been extensively studied in many parts of the world and various aspects of the problem exhaustively explored. However, there were certain clinical manifestations of note, which were encountered quite frequently,

TABLE 2. *Age groups of patients with PCM seen at various periods of the crisis (from 5000 cases).*

Period	Under 5 yrs (%)	5–15 yrs (%)	15–50 yrs (%)	Over 50 yrs (%)
March 1968	89	11	—	—
December 1968	78	15	—	7
June 1969	59	21	7	13
September 1969	45	26	11	21
January 1970	36	21	12	31
June 1970	32	22	11	35

presumably because of the very large number of patients dealt with.

The data were collected from personal experiences with about 10 000 in-patients with severe and moderate PCM and about 100 000 out-patients with moderate and mild PCM in hospitals, mobile medical clinics and field relief teams.

(a) *Ascites*

Many cases of ascites associated with PCM were observed almost always with predominant kwashiorkor. Since it is generally believed that ascites is not a feature of kwashiorkor, our interest was aroused on encountering so many cases. Unfortunately, the laboratory facilities were very limited and the problem could not be investigated fully.

Data were obtained from 100 children under 15 years of age with ascites associated with oedema and quite often other features of PCM, such as skin and hair changes. The condition was found mainly in the older children, being uncommon in children under 3 years of age. A full physical examination was carried out in each case, paying particular attention to signs of congestive cardiac failure. Investigations included measurements of blood pressure, urinary output, urinalysis especially for proteinuria, Mantoux test, haemoglobin and chest X-rays when indicated and when possible.

Analysis of the results showed 21 patiens had heavy albuminuria, and so could conceivably have had nephrotic syndrome. Signs of cardiac failure were observed in 31 patients and 2 patients had abdominal malignancy. Of the remaining 46 patients, 22 had positive reactions to Mantoux test. The remaining 24 had no associated positive findings and had normal chest X-rays. Furthermore, the ascites subsided with the

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TABLE 3. *Ascites associated with kwashiorkor in children (100 cases).*

Other findings	No. of cases
Heavy proteinuria (++to++++)	21
Cardiac failure, due to:	31
Severe anaemia	
Valvular heart disease	
Endomyocardial fibrosis	
Congenital heart disease	
Abdominal malignancy	2
Positive Mantoux test	22
No other associated features (including negative chest X-ray)	24

generalized oedema in 1 to 5 weeks on a high-protein diet alone. Thus, it would appear that ascites occurs in association with kwashiorkor, even though the mechanism is obscure and requires further investigation.

(b) *Hypoglycaemia*

The problem of hypoglycaemia in PCM has been recognized, but not stressed enough. It became of major importance and the commonest cause of death especially in severe cases of marasmus, which occurred in thousands of children. The episodes occurred most frequently in the early hours of the morning, because of the long interval between the evening meal and breakfast. The clinical features included sudden onset of weakness, drowsiness leading to coma, a change in the pattern of respiration usually described as "gasping," muscle twitchings and occasionally generalized convulsions. Unless prompt and effective steps were taken, the patients died in 5 to 15 minutes. The process was quickly reversed by the intravenous administration of hypertonic glucose solution (20%–50%). With the introduction of three-hourly feeding round the clock with a K-Mix (a high-sugar, protein-rich preparation) the incidence of hypoglycaemia was drastically reduced.

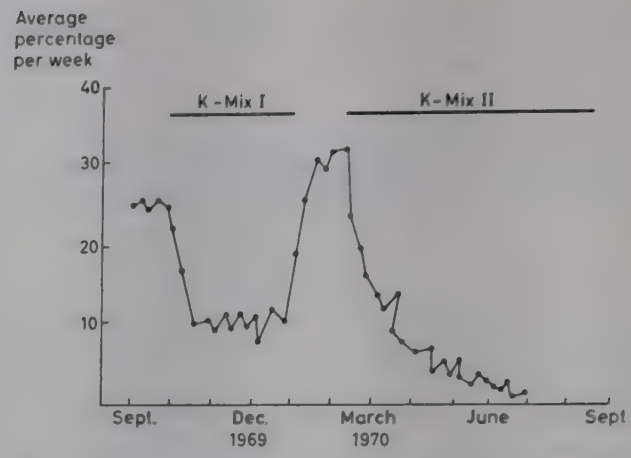

Fig. 1. Incidence of hypoglycaemic episodes in severe PCM with and without K-Mix schedule (expressed as percentage of number of severe PCM cases).

(c) *Anaemia*

Severe anaemia was very common as shown in a group of 500 children whose haemoglobin levels were estimated by a spectrophotometric method. The Hb was 4–9 gm/100 ml in 70% of the cases, and less than 4 gm/100 ml in 18%, with 3% recording less than 2 gm/100 ml. The aetiological factors included malaria, ancylostomiasis, malnutrition, infections and haemoglobinopathies.

(d) *Diarrhoea and Dehydration*

Diarrhoea was a very common problem es-

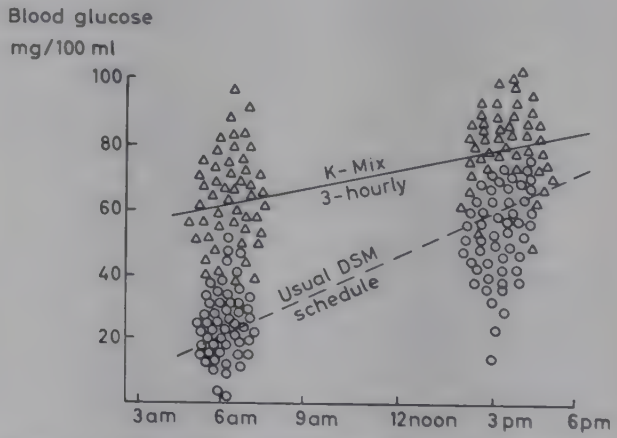

Fig. 2. Blood glucose levels—early morning and afternoon in severe PCM. K-Mix schedule compared with DSM.

TABLE 4. *Haemoglobin levels in children with moderate and severe PCM (500 cases).*

Hb, g/100 ml	No. of cases, %
Above 9	12
7–9	33
4–7	37
2–4	15
Below 2	3

pecially at the start of therapy. However, it soon settled in most cases after 2 to 4 days of proper dietary treatment, and the success of therapy often depended on the severity and duration of diarrhoea. This was especially crucial in the very marasmic children, who withstood diarrhoea poorly.

(e) *Tuberculosis*

Serious concern was expressed about the threat of an epidemic of tuberculosis in a very poorly nourished population. To evaluate the widely differing estimates, 1 000 children aged 0–15 years hospitalized for malnutrition were Mantoux tested using P.P.D. A positive reaction was recorded in 22% of cases, and combined with other clinical features, the prevalence of tuberculosis in the group was estimated at about 14%. However, one striking feature was the occurrence of open pulmonary tuberculosis in young children—several cases in children less than 7 years of age. This was presumably due to the poor resistance to the bacillus as a result of malnutrition.

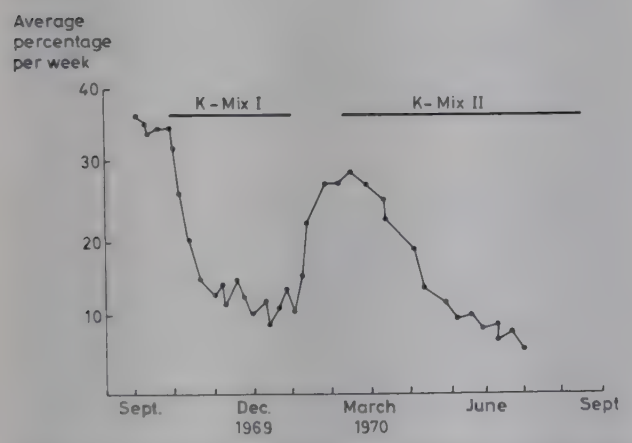

Fig. 3. Incidence of severe diarrhoea and dehydration needing intravenous fluids—with and without K-Mix (expressed as percentage of number of severe PCM cases).

B. Organization of Medical and Nutritional Services

The widespread malnutrition and its associated problems placed a very heavy extra load on the existing health institutions and facilities. It became necessary, therefore, to expand the scope of medical and nutritional attention by setting up emergency institutions. These facilities will be briefly described and the special problems they presented discussed.

Types of Facilities:

(a) *Hospitals*

Many existing hospitals had to shut down because of military action and some emergency hospitals were set up. They catered for the usual medical problems in addition to the war casualties and a large number of cases of malnutrition. The hospitals were staffed by doctors and nurses and they acted as referral centres for the other institutions in the area. The out-patient services of the hospitals played a very important role.

(b) *Sickbays*

These were emergency institutions set up in school or church buildings or in town halls, and sited 2 to 3 miles apart for easy accessibility. Beds were made locally from bamboo and clothing, food and basic drugs were supplied by Relief Agencies.

The sickbays were supervised by a doctor, who was either based in the local hospital or was a member of the Relief Team. He visited at least once a week to

attend to the difficult cases. Cases too difficult to handle in the sickbay were referred to the hospital. The trained nurses were resident and were chiefly responsible for the running of the sickbay. Other members of the staff were chosen from the local community and included auxiliary nurses, an administrator, a storekeeper and cooks. The doctor and trained nurses were generally paid by the government, but the other categories of workers were volunteers and received no salary. However, whilst on duty, they were fed and received food rations in lieu of payment.

(c) *Feeding Centres and Milk Kitchens*

The feeding centres and milk kitchens were established for the mass feeding of malnourished patients and the vulnerable groups. Furthermore, patients discharged from hospitals and sickbays had very little nutritional reserves and required continued regular feeding of cooked meals at the feeding centres to avoid relapse. Conversely, feeding centres served as the pool whence patients were selected for admission.

These facilities were organized at the village level and run by a Feeding Centre Committee representing all the sections in the community. They acted as an effective buffer for the hospitals and sickbays by dealing with the less severe cases of malnutrition and thus keeping them out.

(d) *Mobile Clinics*

These clinics were run by Aid to Biafran Children, an American philanthropic organization. The team consisted of a doctor, a nurse and an assistant. The nurse helped the doctor by sorting out the patients and dealing with the simple cases, and the assistant helped in dispensing the medicines and foods and in crowd control. Transportation was by a four-wheel drive vehicle, because quite often the team had to travel on rough roads to reach the areas close to the war zones. Simple conditions were treated in the clinic and the more serious cases were issued identification tags and evacuated to the base hospital.

(e) *Out-patient Clinics—A system for coping with very large attendances*

As the number of cases of malnutrition increased manyfold, the attendances at the Outpatient Clinics became too many for the doctors to handle. A system of pre-sorting the patients was therefore devised. The sorting was done by a specially trained nurse, who selected the serious and complicated cases from the crowd of patients and sent them to the doctor. The rest were seen by trained nurses. In order to facilitate this, a special card was printed tabulating the degree of malnutrition, and providing columns for milk and the drugs used in treating the common conditions, e.g. chloroquine, iron, multivitamins, folic acid, bephenium and benzyl benzoate.

From a quick history and physical examination, a diagnosis is made and the treatment prescribed by placing a "tick" in the appropriate columns. The medicaments are dispensed by an attendant provided with a dosage table and the drugs are swallowed on the spot with a cup of milk provided. The system is expeditious and each nurse could attend to 50–70 patients an hour.

Special Problems

(a) *Selection of persons to be fed*

In a situation where there was almost universal need for food, general feeding of the entire population would have been ideal. But for logistical and other reasons, the amount of food was far short of the desired amount. It was therefore imperative that the food be given to the selected groups,

who needed it most. These were in order of priority:

1. Patients with overt malnutrition—of any age
2. The "vulnerable" groups:
   (i) Children under 5 years of age
   (ii) Lactating women
   (iii) Pregnant women
   (iv) The very old people.

The process of selecting patients with malnutrition presented a problem in marginal cases. The accepted age/weight, or height/weight standards were impractical in dealing with very large numbers of patients often by inexperienced personnel. There was thus a great need for a simple reproducible method of assessing malnutrition. A method devised by a team of the Quaker Service was the "Quaker Upper Arm Circumference (Q.U.A.C.) Measuring Stick." The "QUAC" Stick method is a modification of the Height/Upper Arm Circumference Standard, and even though it had its limitations, it worked out well as a rapid screening test.

(b) *Need for Surveillance—periodic nutritional surveys*

The nutritional situation was rapidly changing, and it was important for a monitoring service to be set up to detect areas of greatest need and evaluate the effectiveness of the programmes. Nutritional survey teams were set up to sample the population at periodic intervals. One of the problems encountered was the bias of the observers, according to whether they felt that more or less food was required in a particular area.

(c) *Family Tracing System; Policy on Orphanages*

The war necessarily split up families, and thousands of children were separated from their families for varying periods of time up to $2\,^1/_2$ years. After the war, steps had to be taken to reunite them with their families and the methods adopted included:

(i) notification through various information media as to the centres where the children were located. The parents or relatives called to identify and claim their children.

(ii) The older children who could supply the details about their homes were grouped according to their areas of origin. They were then transported in batches and delivered to their addresses.

(iii) The younger children, under 3 years of age, presented the biggest problem. But, by displaying them or their photographs in public places, some were identified and claimed by their parents.

If every effort is made, as outlined above, it should be possible to place the vast majority of the children in their homes; if not with their own parents, with their next of kin.

The policy strongly advocated at the end of the war (and, happily, is now accepted as official policy was that orphanages as permanent institutions should be actively discouraged. A home, even if poor, is preferable to a comfortable orphanage, when the long-term future of a child is considered.

The concept of orphans is completely foreign to our traditional society. It would be a great pity if even the war, with all its tragic consequences, was allowed to disrupt the admirable closely-knit family units with the extended family system. Under this system, no child is ever left uncared for. The responsibility for a child who has lost its parents or whose parents are incapable of caring for, automatically falls on the next of kin. This praiseworthy system must not be disrupted by the novel idea of orphanages, which encouraged

people to shirk their traditional responsibilities. It would thus result in rearing children in institutions, who grow up without roots in families, with all the attendant evils, including maladjustment and social complexes that very often develop.

"Orphanages" as established now should be no more than centres where the children separated from their parents or next of kin are looked after temporarily, whilst attempts are made to return and integrate them with their families, or failing that, place them with responsible foster families or have them legally adopted into homes. There are thousands of children in this category and the machinery for doing this is being established.

C. Mass Immunization Programme against Measles, Smallpox and Tuberculosis in a War Situation

Introduction

Mass immunization programmes under ideal peacetime conditions with very careful and elaborate planning are beset by difficulties. In a war situation these difficulties are magnified manyfold. Nevertheless, it is in such a setting that the need for a mass immunization programme is most urgent.

Measles is known to be a far more serious disease in children in West Africa than in Europe or North America. Under normal circumstances, the mortality rate for measles in general is about 5% and this figure approaches 25% in children admitted to a hospital with complications. In the war-affected areas of Eastern Nigeria in late 1968, most of the children were suffering from varying degrees of malnutrition, and therefore had a very low resistance to measles. If the usual December to March measles epidemic had been allowed to occur, with the widespread malnutrition and the very poor and overcrowded conditions in refugee camps, it would have resulted in a catastrophe on an unprecedented scale. The number of children at risk (0–5 years of age) was estimated at $1\,^1/_2$ million.

It was against this background that a short urgent appeal in November 1968 was made to the Relief Agencies for a mass immunization programme against measles in children. Since the smallpox vaccine could be given with the measles vaccine and because of the ever-present danger of a smallpox outbreak, a combined Measles-Smallpox Immunization was proposed.

The first batch of vaccines arrived on Christmas Day 1968, and the campaign began on 27th December 1968. In September, 1969, B. C. G. vaccine was added to the programme because of the threat posed by the increasing rate of spread of tuberculosis.

Organization of the Programme

(1) A three man *Campaign Administrative Committee* made up of one representative of the Relief Agencies, one from the Ministry of Health and myself, was set up and was responsible for:

i. Day-to-day running of the programme

ii. Selection, training and control of teams

iii. Planning of phases of the programme

iv. All equipment, fuel, vehicles, and records

v. Publicity and health education in cooperation with the Ministry of Health

vi. Regular progress reports to the Ministry of Health and the Relief Agencies.

The staff for the programme was made up of nearly 100 persons and most of these were members of the nine field teams.

The *programme* was operationally organized on a divisional basis with the Divi-

sional Officer, in close co-operation with the Medical Officer, the Catholic and Protestant priests and Village Chiefs. The Divisional Officer helped in securing accommodation and arranging for the feeding of the team members whilst they were in the field and was responsible for publicity through the Local Councils, Churches, Clan or Village heads, Refugee Camp Directors and Representatives of the Relief Agencies.

The teams left the operational headquarters every Monday morning and returned on Saturday afternoons. They lived all week in the field base, travelling out to the centres early in the morning and returning in the evening. They were expected to work from 6 or 7 a.m. until 5 or 6 p.m. with an hour's break for lunch. The work of the teams received close supervision from the doctors on the programme, who conducted spot field checks.

Smallpox vaccine was given to all adults and children. Measles vaccine was given to all children over 6 months of age and under 40 inches tall (approximately 5 years). B.C.G. was given to everyone up to 20 years.

Equipment and Supplies

The measles vaccines used were obtained from the relief organizations and was initially the Schwartz strain and later the Moretan strain. The smallpox vaccine used was the dry lyophilized type. The B.C.G. used was made by the Pasteur Institute. All these vaccines were specially made and adapted for use with the Pedojet injector gun. A total of 62 Pedojets were used and these were serviced regularly by the Pedojet Maintenance and Repair Unit trained locally.

Constant refrigeration was vitally important to maintain the potency of the measles vaccine, in particular. Two electric freezers, seven electric refrigerators and thirteen kerosene refrigerators were used. The kerosene refrigerators were generally the most satisfactory for storing the vaccines. In the field, the vaccines needed by the team were stored in a kerosene refrigerator near to the operational base and transported in insulated cooler chests, kept cold with frozen "cold dogs".

Land Rovers (long wheel-base type, hard top) were used in the field and were admirably suited as team vehicles. They were big enough for carrying the team members and their equipment and the four-wheel drive was very useful for going on rough roads necessary to reach the areas close to the war zones.

Petrol, diesel and kerosene was needed for the vehicles and refrigerators.

Difficulties

The chief difficulties encountered in the programme were:

1. Vehicles were inadequate in number and often broken down due to lack of proper service facilities and spare parts.
2. Fuel supplies were often inadequate and unreliable.
3. Refrigeration for the vaccine was a problem initially but this was largely solved by the use of kerosene refrigerators.
4. Communication, having regard to the complete absence of press, radio, postal, or telephone services was a major problem.
5. Mobility of the population due to ever-changing front lines and resultant mass migration presented problems.
6. Military operations hampered the programme particularly in areas close to the fighting zones.
7. The constant fear of air raids made people very apprehensive of gathering in large numbers, but this was partly over-

come by starting the programme very early in the morning and conducting it under cover.

Results

The total number of vaccinations given up till January 10th 1970, were:

Smallpox	2 530 000
Measles	910 000
Tuberculosis (B.C.G.)	300 000

Various attempts have been made to estimate the percentage coverage of the programme. But this is difficult because of the mobility of the refugee population, lack of reliable population figures, and the fact that the programme had not been completed before the war ended. However, from various pieces of evidence the percentage was estimated at:

Measles	about 45 %
Smallpox	about 55 %

(taken together with previous recent vaccination).

The effectiveness of the programme could be judged by the fact that the epidemic that was feared in 1968/69 was aborted and relatively few cases of measles occurred in the 1969/70 season. Most of the 1969/70 cases came from areas known not to be covered by the campaign because they were inaccessible due to military action. No confirmed case of smallpox occurred in Eastern Nigeria during or since the war.

Paired samples of sera from 500 children were obtained before and 4 to 6 weeks after measles vaccination. The antibody titres were estimated at the Pasteur Institute, Paris. The clinical data, including the nutritional status were recorded in each case. I regret my inability to present the detailed results here. But there was a conversion rate in over 95 % of cases. Furthermore, there was satisfactory antibody response even in children with severe malnutrition, showing that they were capable of immunological response to the antigenic challenge of the vaccine.

Although a complete follow-up of our programme was impossible, it should be noted that in the many institutions where follow-up was possible, we did not encounter any problems with complications due to any of the vaccines.

D. Several High-Protein Preparations Utilized

(1) Kwashiorkor Food Mix (K–Mix II)

K-Mix II is a food mix made available by UNICEF and based on the same ingredients as the well known Milk Protein Diet (MPD), but in different proportions. Although the formula is not new, it had the opportunity of being used in extensive trials on thousands of children with PCM in hospitals and in sickbays.

Composition of K-Mix II[1]

K-Mix II is a powder packaged in 2 kg plastic bags and consists of:

Calcium Caseinate	3 parts by weight
Skim milk powder	5 parts by weight
Sucrose	10 parts by weight

It is prepared for use by mixing:

100 gm	K-Mix II
60 gm	vegetable oil

Cooled boiled water to make 1 litre total mixture Groundnut oil was used in these trials, but other vegetable oil may be used. Oil of animal origin is unsuitable as it may provoke or aggravate diarrhoea.

[1] In some of the figures is mentioned K-Mix I. This mixture is similar to K-Mix II, the only difference being that it contains two parts of calcium caseinate instead of three.

Procedure in Use of K-Mix II

K-Mix II is designed for children with severe kwashiorkor and its use was restricted to this group of patients in our trials.

Feeding was done by cup in all cases except the 5% who were unable to drink. These children were fed by nasogastric tube. The children were fed every 3 hours both day and night to lessen the danger of hypoglycaemia. Spot checks were done at night to make sure the children received all of their feedings.

The control group was fed a supplemental diet of dried skim milk on the same schedule.

Results

The following was noted in children on K-Mix II as compared with the control group:

1. Oedema was gone in an average of 4 to 5 days (no difference)
2. Weight gain was more rapid
3. The number of hypoglycemic episodes were much fewer
4. Blood glucose levels in the early morning hours were higher
5. The number of children requiring I.V. fluids as a result of diarrhoea was markedly lower
6. The case fatality rate was markedly lower

(Most deaths in the control group were from dehydration or hypoglycaemia.)

Discussion

K-Mix II has several practical advantages in addition to those obvious from the above results: (1) It is well accepted by children because of its sweet taste; (2) It dissolves easily in water and passes easily through a nasogastric tube, thereby being easy to manage.

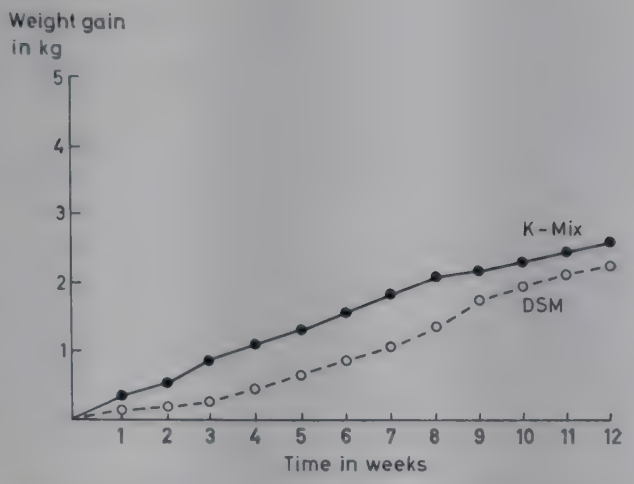

Fig. 4. Average weight gain in severe PCM after loss of oedema. K-Mix schedule compared with DSM.

(2) Post-Kwashiorkor Food Mix (P.K.F.M.)

P.K.F.M. is another preparation by UNICEF and introduced into the Relief Operation in Nigeria in April, 1970, as an addition to the armamentarium for the cure and prevention of protein calorie malnutrition (PCM).

The composition by weight of dry mixture is as follows:

Corn (Maize meal)	40%
Full fat soy flour	38%
Dry Skim Milk	5%
Sugar (Sucrose)	15%
Vitamin–Mineral Mixture	2%
Added vanilla flavour	

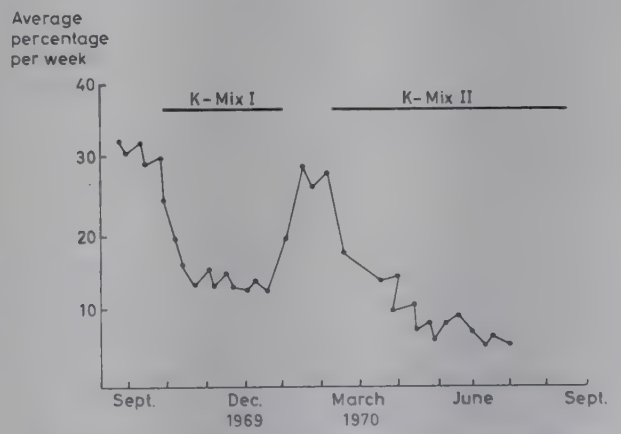

Fig. 5. Case fatality rate in severe PCM—with and without K-Mix. (No. of deaths expressed as percentage of no. severe PCM cases.)

Dry P.K.F.M. is fully pre-cooked and contains 20% protein, 8% fat and provides 400 calories per 100 gram.

Uses: P.K.F.M. has been found to be very valuable in the continuation of the management of cases of severe PCM once the critical acute stage is over and a more substantial food than K-Mix II exclusively can be fed. In moderate cases of PCM it is used right from the start of treatment. P.K.F.M. makes an excellent "pap" (or porridge), which is the traditional breakfast for children and weaning food for infants in Nigeria and normally made from cornflour and water. It therefore, found ready acceptance by both children and mothers. Between 100 and 200 gm of P.K.F.M. would be required to make "pap" for a child, depending on the consistency desired.

The food preparation was very well accepted and tolerated by the children because of its sweetness and vanilla flavouring. The fact that it was precooked was especially important in the villages where facilities for elaborate preparation were lacking.

(3) Wheat Soy Blend (W.S.B.)

Wheat soy blend is prepared by the U.S. Department of Agriculture. Like C.S.M. it is a high-protein food—20% protein, but has the advantage of being precooked. It can be used for making bread and for preparing "foo-foo" which is a traditional meal, and so eminently acceptable to the population.

Summary

The material presented was based on a four-year experience in various hospital and Public Health programmes before, during, and after the war in Eastern Nigeria (Biafra).

Protein-calorie malnutrition (PCM) was not a major problem in this area before the war, and there was a sudden outbreak in "epidemic" proportions as a result of the hostilities.

From observations on about 10 000 inpatients with severe PCM and 100 000 outpatients, certain noteworthy clinical features are described. Ascites associated with PCM was seen frequently and in a proportion of these cardiac failure, the nephrotic syndrome and tuberculosis were excluded. Hypoglycaemia was of major importance in marasmic children, requiring intravenous hypertonic glucose to avert death. The regular, frequent feeding with K-Mix II (high sugar protein-rich food) drastically reduced the episodes. Anaemia, diarrhoea leading to dehydration and tuberculosis were other features that attracted attention.

The heavy burden imposed on the existing medical facilities, necessitated the use of emergency hospitals, sickbays, feeding centres, mobile clinics and outpatient clinics. The difficulties that arose with relocation of the separated children with their families are discussed.

The problems posed by mass immunization programmes against measles, smallpox and tuberculosis in a war situation are described. It is stressed that in spite of the difficulties, every effort should be made to mount a preventative Public Health programme in times of disaster.

Finally, some high-protein preparations utilized in the management of the patients with PCM are presented. These are Kwashiorkor Food-Mix (K-Mix), Post-Kwashiorkor Food Mix (P.K.F.M.), and Wheat-Soy Blend (W.S.B.).

Rapporteur: Wenche Barth-Eide

Stroh drew attention to the hostility and suspicion that will rise against those coming from abroad to operate in a relief situation. This is first of all caused by the general psychological attitude in most of the countries that are to bring assistance. The tendency to over-simplification and the creation of certain attitudes and sensations will easily lead to a heated climate destructive to cooperation. Stroh shared Omolulu's views on the errors committed by people coming from abroad during the Nigerian war. There was, however, a tremendous difference between the two areas. Comparing results with costs and efforts, the situation was far better on the rebel side. In the reconquered areas there was much destruction, shortage of staff and equipment, and people were insecure and difficult to cooperate with. The opposite was the case in the rebel area, where also distances became shorter and shorter, thus facilitating communication and coordination. The difficulties on the organizational level under the leadership of ICRC had historical reasons: there had been agencies of very different kinds working in the area before the war, and when the situation became acute, others rushed in. ICRC accepted or took responsibility for these highly disparate kinds of organization: The leadership was weak until a very late stage, with the results that logistics were improvized far too long, personnel was not always selected in a satisfactory way and the methods used showed great variation. The lack of real African contribution to the leadership of international activities was another point. There is a general shortage of really good administrators and technicians in most developing countries, and the people needed will normally be busy in universities, business and administration and thus difficult to get hold of, especially when the serious character of the situation is not recognized. It therefore becomes of utter importance to have some kind of common language to define when a disaster situation does exist. Pre-planning is also extremely important and should be the responsibility of the government, although voluntary agencies may contribute and assist. With a decent number of Africans in leading positions, relief operations might have been less difficult. However, *Stroh* found it encouraging to observe that the Nigerian Red Cross really had grown with its responsibilities and the Rehabilitation Commission also is very much more effective today than it was in 1968.

Aall discussed the danger of looking upon relief operations *per se* and forgetting to regard them in their proper context. Both the pre-existing situation and that which may develop afterwards must be considered, otherwise much of the effort in a relief operation might be in vain or lose impetus. A relief operation ought to be launched and carried out in such a way as to allow for a gradual phase-out combined with a hand-over to national authorities, possibly supported by UN-bodies so that, whenever possible, relief efforts may fit into long-term development programs. Another important point is to take care even from the very beginning to make fullest possible use of local resources and regard outside support only as supplementary. At the same time it is important that, through relief efforts, one should not aim very much above the pre-crisis nutritional level, because of the effects on the then inevitable relapse and deterioration when the relief operation comes to an end.

According to *Viteri,* recent surveys in Central America had shown that men appear to be more susceptible to adult PCM than women, contrary to what had been expected. Another observation had been the high prevalence of anemia. *Viteri* stressed, however, that this always reflects the previous nutritional status and not an acute shortage of food. As a matter of fact, during the development of acute protein-calorie malnutrition mild iron deficiency anemia even disappears. This is a consequence of the faster rate of active tissue mass loss, especially with respect to total circulating red cells and thus total hemoglobin value. Transfusions should therefore normally not be regarded as an emergency operation, especially as these may represent certain dangers to the central nervous system. Data from INCAP also indicated that in PCM diarrhoeas are not more of infectious origin than they are in the general population. It may therefore save time and efforts to treat the nutritional conditions rather than treat the diarrhoea as if it were of infectious origin.

PALESTINE ARAB REFUGEE WORK

by Dr A. J. S. Jabra[1]

Historical background

In the long history of mankind, the world has witnessed many disasters, culminating in relief operations often stretching over a period of weeks, months or even years. In the case of the emergency relief operations for the Palestine Arab Refugees, it has now entered its third decade.

On the 20 November 1947, the United Nations General Assembly recommended that Palestine be partitioned into three areas, each being autonomous but bound together by an economic union. There was to be a Jewish state and an Arab state, and the international enclave of Jerusalem to be administered by the United Nations Trusteeship Council.

Following the Partition Resolution, accepted by the Zionists but not by the Arabs, civil disturbances broke out in Palestine. From this time until 15 May 1948, when the British Mandate expired, and the state of Israel was proclaimed, some 30 000 Palestine Arabs left their homes. On 15 May, the Palestine war began and as a result, some hundreds of thousands of Palestinian Arab men, women and children were uprooted from their homes and lands during 1948–49, and sought refuge in Transjordan, Syria, Lebanon, the Gaza Strip, Egypt, Iraq and in East Palestine. While the estimates vary, the UN Economic Survey (CLAPP) Mission calculated the number to be about 726 000 of whom 652 000 were considered in need, although there were said to be some 971 243 on relief on 30 September 1949 in the Arab countries and 48 000 in Israel.[9] The refugees' condition was indescribably wretched. In most cases they had managed only to save the clothes on their backs, and took shelter in caves and deserted buildings or camped out on waste lands. A small percentage left Palestine with limited resources sufficient to make them self-supporting for a few days, weeks or months as the case may be, but most of them fled from their homes without anything but what they were wearing. Many arrived with practically no clothing (2).

From the inception of the Palestine refugee problem, relief work was carried out by various Arab Governments, churches and voluntary organizations.

The work of these voluntary organizations was coordinated by the UN Mediator Count Folke Bernadotte until November 1948 when the United Nations Relief for Palestine Refugees was founded (UNRPR) (5). A Director of the UNRPR was to assume responsibility for overall planning and implementation of the relief programme while operational activities were to be entrusted to the International Committee of the Red Cross, the League of Red Cross Societies, and the American Friends Service Committee. The UNRPR provided these organizations with money and supplies.

When hope of finding a rapid solution of the problem of the Palestine refugees had

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faded, the United Nations General Assembly, in its resolution of 8 December 1949 (6) established the United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA) to administer relief services to the refugees (9).

Alimentary relief provided

Before the establishment of UNRWA, the UNRPR provided the following food issues for the refugees (1):

(*a*) A monthly ration for about 900 000 refugees, consisting of flour, lentils, rice, oils or fats, and sugar. Sometimes tinned fish was included in the ration. In minor features, the ration differed from area to area.

(*b*) Reconstituted skim milk was distributed and consumed at schools by school children and at milk distribution centres by groups of pregnant and lactating women, medical cases and children not attending schools.

(*c*) Reconstituted skim milk was also issued to a number of families selected by UNICEF.

(*d*) Reconstituted evaporated whole milk, one part, and skim milk, one part, was also available in milk distribution centres for infants under 2 years of age.

(*e*) Liquid Cod Liver oil was distributed during the winter to school children and those drinking milk at the milk distribution centres.

(*f*) Vitamin C tablets were distributed to school children (in Gaza only), the dose was 25 mg daily.

The monthly ration which obviously lacked all fresh food items and animal proteins was calculated to yield 1 647 calories per capita per day, and was believed to be probably close to the per capita calorie requirement of the groups during summer, but was several hundred calories below requirements in winter, and the severer the winter conditions, the greater the discrepancy. The ration also provided about 40–50 g protein per day, almost all of which was of vegetable origin. The ration was low in vitamin A and deficient in vitamin C. The issues of milk, cod liver oil and vitamin C as outlined above certainly helped to meet at least part of the extra requirements of the vulnerable groups.

During the very early days and before the distribution of rations and other supplements was so arranged, the nutritional state of adults appeared to be reasonably satisfactory, except in certain areas where conditions were bad for everybody. But as might be expected, children and old people were in the worst state. Moreover, evidence of vitamin deficiency was observed among the refugees, as well as few cases of famine oedema in the worst hit districts (Kirk and Abbasy, 1948) (2).

The distribution of the monthly rations and other food supplements seemed to have improved the nutritional state of the refugees. Data collected on preschool and school children 18 months later (Clements, 1950) showed that their nutritional status was reasonably satisfactory and there were no cases of starvation or even semi-starvation. However, vitamin C deficiency signs were observed in a high proportion of the children and signs suggestive of riboflavin deficiency were also seen (1).

The United Nations Relief & Works Agency for Palestine Refugees began actual operation on 1st May 1950. As its full title indicates, UNRWA received a dual mandate from the General Assembly; firstly to provide relief based on need and secondly to carry out a programme of work with a view to assisting in the economic rehabilitation of the Palestine refugees (10).

According to UNRWA definition for registration purposes, a Palestine refugee is a person whose normal residence was Palestine for a minimum of 2 years immediately before the outbreak of the conflict in 1948 and who, as a result of this conflict, lost both his home and his means of livelihood. Presently, to be eligible for UNRWA assistance he must be registered as in need, and must have taken refuge in 1948 in Jordan, Lebanon, the Syrian Arab Republic or the Gaza Strip, the areas within which the Agency operates. Children of registered refugees are also eligible for assistance.

The UNRWA relief services include the distribution of monthly basic rations and the supplementary feeding programme. About 62% of the refugees are issued with basic rations every month and about 250 000 refugees, mainly infants and children, benefit from UNRWA's programme of supplementary feeding and milk distribution (12).

UNRWA food distribution programme established early in 1950 has been maintained over the years, with minimal changes and consisted of:

1. *Monthly basic rations* composed of 10 kg flour, 600 g pulses, 600 g of sugar, 500 g of rice and 375 g of oils or fats. This provides about 1 500 calories and 42 g protein per day. In winter a further 400 g flour and 300 g pulses are added to the monthly ration bringing the daily number of calories up to about 1 600 and the protein to 44 g. By itself this monthly ration is unbalanced and inadequate. However, the refugee population appears to have adapted themselves well to this ration and knows how to make good use of it. Most refugees manage to add a little meat, eggs, vegetables or fruit, either grown by themselves, bartered for part of their rations or bought with earnings.

2. *Milk and Supplementary Feeding Programme.* Since the UNRWA monthly basic ration is dietetically inadequate, lacking as it does, all fresh food items and all proteins of animal origin, the Supplementary Feeding Programme has been established to protect and promote the health of the vulnerable groups among the refugee population, notably infants, children in the preschool and school age, pregnant women, nursing mothers and tuberculous patients under domiciliary treatment (7). The Supplementary Feeding Programme includes:

2.1. A daily issue of reconstituted whole-skim milk mixture for a maximum of 6 600 infants aged 6 to 12 months as well as for those under 6 months who cannot be breast fed.

2.2. A portion of reconstituted skim milk on 6 days a week to a maximum of 51 000 children aged 1–6 years, and expectant and nursing mothers from the beginning of the fifth month of pregnancy and for 1 year after delivery. Same issue is also made to other refugees upon medical recommendation.

2.3. A portion of reconstituted skim milk is also available to about 96 000 children in elementary schools on 5 days a week.

2.4. A monthly issue of 500 g CSM (cornflour, soya and milk mixture) is made available to about 43 500 children in the age group 6 to 10 years; providing about 60 calories and 3.5 g protein per day.

2.5. Nutritionally balanced hot meals are provided at Agency Supplementary Feeding Centres on 6 days per week, on an "open" basis to all children up to the age of 6 years and on medical recommendation to children between 6 and 15 years and to a number of

sick adults with a maximum of 50 500 beneficiaries. Such meals provide on the average about 250–700 calories and about 15–30 g protein per meal per day according to the age of the individual beneficiary (3).

2.6. A special high protein high calorie diet ("Post-Diarrhoea menu") is provided for infants and young children suffering from gastro-enteritis and malnutrition.

2.7. Vitamin A & D capsules are issued daily to children 1–6 years of age and elementary school children during the school summer vacation if attending the hot meal programme. They are also issued to elementary school children at the time of the school milk distribution on 3 days a week. Over 20 million capsules are distributed annually.

2.8. A special extra dry ration is issued to expectant mothers from the fifth month of pregnancy and for a year after delivery with a maximum of 31 500 beneficiaries and consists of 3 kg flour, 825 g pulses and 200 g oils or fats and provides on the average about 505 calories and 17 g protein per day.

2.9. About 1 500 tuberculous outpatients receive a monthly supplement equivalent to the UNRWA monthly basic rations.

A second flight

The military conflict which suddenly erupted and engulfed large areas in the Middle East in early June 1967, and directly involved three countries in which UNRWA operates, resulted in mass displacement and deprivation not only of UNRWA registered refugees, but other sections of the population as well, seeking refuge and protection. At 31 December 1967 it was estimated that in east Jordan there were approximately 250 000 displaced persons (including 125 000 UNRWA registered refugees from the West Bank and Gaza); in Syria 116 000 (including 16 000 UNRWA registered refugees); and in the United Arab Republic 77 000 (including 12 000 UNRWA registered refugees) (4). In other words, some 150 000 refugees from the 1948 conflict were uprooted for a second time in their lives.

Emergency assistance

Emergency assistance for Arab refugees in the Middle East in the summer of 1967 was a combined operation to which the governments directly concerned, other donor governments, the Red Cross and the Red Crescent, UNRWA, UNICEF, the specialized agencies, national and international non-governmental organizations and countless individuals in many parts of the world all made essential contributions. As a United Nations Agency long established in the area and immediately connected with the problem, UNRWA found itself acting as an intermediary and a source of information on matters of general concern (8). For a comparatively short period the displaced refugees were at first hurriedly accommodated in schools and public premises while many found shelter with relatives and friends; bread and certain items such as cheese, sardines and jam were provided. Almost immediately emergency tented camps (now sheltering about 100 000 persons) were established in East Jordan and Syria and arrangements were made by UNRWA to provide a balanced double hot meal per capita per day.

The process of registration and verifica-

tion of the refugees took the Agency approximately 4 weeks before the distribution of the monthly basic rations was re-established. Meanwhile the refugee families in the emergency tented camps were provided by the Agency with the so-called "family kits" consisting of a cooking stove, pots, pans and eating utensils. The regular distribution of monthly rations and the provision of the family kits, made it possible for the refugees to cook their own food, and for the Agency to restrict the distribution of hot meals to children up to 15 years of age only.

Similarly, the daily skim milk distribution programme normally available to children aged 1–6 years, was extended to include all displaced children aged 7–15 years.

For further nutritional protection of the displaced refugees, a special protein supplement to the monthly basic rations consisting of one 12 ounce tin of meat and 500 g CSM was introduced at an early date and is still being issued monthly to all displaced refugees living in the emergency camps in East Jordan and to all displaced refugees in Syria.

In addition, a monthly extra ration consisting of 600 g flour, 500 g rice and 500 g fats was provided for a time to displaced refugees living in tented camps in Syria, in conformity with rations issued by that country to its new displaced nationals.

In the West Bank of Jordan and in the Gaza Strip similar emergency assistance was extended to thousands of refugees on the basis of economic hardship. In the West Bank the inhabitants of the frontier villages fled during the fighting or moved out or were moved out afterwards. At one time the total number of persons thus rendered homeless exceeded 20 000 (8). In both the West Bank and the Gaza Strip many thousands were no longer self-supporting because of a sudden loss of employment or of income from remittances from abroad. In both areas an increased ration issue was authorised, special milk issues and daily hot meals were made available to children up to the age of fifteen; the protein supplement was made available to all pregnant and nursing mothers from the fifth month of pregnancy and for a year after delivery, as well as to tuberculous outpatients.

Conclusions

In spite of the Agency's financial difficulties, and the limited budgetary provisions earmarked for the Feeding Programme, the Agency has succeeded in maintaining the health and nutrition status of the refugees over the past 20 years at a satisfactory level as evidenced by the lowering of the incidence of malnutrition and as witnessed by the number of surveys carried out at various intervals of time including two surveys by the ICNND in Jordan and Lebanon (1962 and 1963) and one by a WHO MCH/NUTRITION Team (1968) as well as a number of surveys carried out by the Agency itself.

In general, UNRWA keeps regular and careful surveillance over infants attending infant health centres and particularly over those found to be in a marginal state of malnutrition as well as those who show more specific signs of protein-calorie malnutrition.

I have already made allusions to the Agency's financial difficulties. In spite of the continuous efforts made by the Commissioner-General of UNRWA and the personal intervention of the Secretary-General of the United Nations for raising more contributions, the situation has now become extremely critical because of the annual deficits which have accummulated over the

last years; near 4 million dollars in 1969, about 5 million dollars in 1970 in all probability and, unless resources increase substantially, between 5 and 6 million dollars in 1971. This means that the Agency's working capital is now reduced to little more than the amount required to finance supplies in stock and in the pipeline.

In spite of the reductions in expenditure which had to be made earlier this year, the cash position of the Agency is becoming critical and, if no action is taken by the General Assembly or by individual member states or other donors, to dispose, in one way or another, of the deficit estimated for 1971, not only the Agency's working capital but the Agency's cash would be exhausted well before the end of the year with the inevitable result of a breakdown in services and inability to meet its accrued liabilities.

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ANNEX I. *Rations and supplementary feeding issues.*

Ration	Quantity (g)	Beneficiaries	No. of benef.	Nutritional value
1. Basic rations	*Monthly* Summer scale Flour 10 000 Pulses 600 Rice 500 Oils/fats 375 Sugar 500 Winter scale As above plus Flour 400 Pulses 300	Refugees eligible for UNRWA assistance	857 111	1 500 cal and 42 g protein per day 1 600 cal and 44 g protein per day
2. Whole/skim milk mixture	*Daily* Whole milk 30 Skim milk 30	All infants, 6–12 months and non-breast fed below 6 months Displaced infants, 3–6 months	6 600 200	255 cal and 18 g protein per day
3. Skim milk	*Daily* (6 days/week) Skim milk 40	All children, 1–6 years.; pregnant & nursing women; sick adults Displaced children 6–15 years.	51 000 20 500	125 cal and 12.3 g protein per day
4. School milk	*Daily* (5 days/week) Skim milk 40	Elementary school children	96 000	96 cal and 9.5 g protein per day
5. Hot meals	According to daily menus	Open to all children below 6 years and upon medical recommendation to older ones Displaced children, 6–15 years	50 500 11 500	250–700 cal and 15–30 g protein per day depending upon the age of beneficiaries
6. Extra ration for pregnant and nursing women	*Monthly* Flour 3 000 Pulses 825 Oils/fats 200	Pregnant women from 5th month of pregnancy and for 12 months after delivery	31 500	505 cal and 17 g protein per day
7. Extra ration for tuberculous out-patients	*Monthly* Similar to basic rations	Tuberculous patients under domiciliary treatment and observation	1 585	1 500 cal and 42 g protein per day in summer and 1 600 cal and 44 g protein per day in winter

Ration	Quantity (g)	Beneficiaries	No. of Benef.	Nutritional value
8. CSM for children 6–10 years	*Monthly* CSM 500	Children 6–10 years old	143 500	60 cal and 3.5 g protein per day
9. Vitamins	One A & D capsule 6 days per week	Children 0–6 years attending the hot meal programme	37 500	5 000 units vitamin A[2] and 1000 units vit. D calciferol per capsule
		Elementary school children attending the hot meal programme during the school summer vacation	12 400	
	One A & D capsule 3 days per week	Elementary school children together with the school milk	95 500	
10. Protein supplement	*Monthly* Meat tin 340 CSM 500	All displaced refugees in Syria, displaced refugees living in emergency camps in E/Bank, pregnant & nursing women and T.B. outpatients in E/Bank, Gaza and W/Bank	69 200	84 cal and 6.3 g protein per day

ANNEX II. *Financial information* ($).

Total UNRWA budget for 1970	45 908 000
Basic rations	10 053 525
Supplementary Feeding Programme :	
(*a*) Administration	95 756
(*b*) Hot Meal Programme	1 368 289
(*c*) Milk programme	287 287
(*d*) Extra rations	409 998
Total	2 161 330
Non utilization	79 000
Net supplementary feeding budget	2 082 330

ANNEX III. *Supplementary feeding centres.*

Country	No. of feeding centres	No. of milk centres	No. of rehydration / nutr. centres
Jordan (East)	15	16	7
West Bank	35[a]	30	1
Gaza	24	24	6
Lebanon	18	21	3
Syria	18	19	3
Total	110	110	20

[a] Including 5 centres run by Voluntary Agencies.

ANNEX IV. *Percentages of infants according to degree of underweight January–December 1969.*

Field	1st degree	2nd degree	3rd degree	Total
Infants 0–1 year				
Jordan (east)	10.7	4.7	0.7	16.1
West Bank	8.7	4.0	0.6	13.3
Gaza	7.6	3.5	0.5	11.6
Lebanon	9.3	4.1	0.7	14.1
Syria	5.6	3.4	0.6	9.6
Total	8.5	3.9	0.6	12.9
Children 1–2 years				
Jordan (East)	13.8	7.1	0.5	21.4
West Bank	11.3	4.6	0.3	16.2
Gaza	9.7	6.1	0.6	16.4
Lebanon	13.0	6.3	0.4	19.6
Syria	5.6	3.4	0.3	9.3
Total	11.0	5.8	0.5	17.2

Note: (1) Percentages of 1st, 2nd and 3rd degrees underweight are calculated against the no. of infants and children *attending* Infant H.C.s and not against the no. of infants and children registered. (2) Degrees of underweight are based on the following percentages of average theoretical weight for age: 1st degree 75–85 %, 2nd degree 60–75 %, 3rd degree below 60 %.

WHAT KINDS OF FOODS SHOULD PRIMARILY BE PROVIDED, PARTICULARLY FOR YOUNG CHILDREN, IN FAMINE?

by L. J. Teply[1]

Introduction

The selection of foods to be supplied in emergencies should be influenced by many factors including:

Foods locally available
Foods available from the outside
Nutritional status of the recipients
Food preferences of the recipients
Transport possibilities
Facilities for distribution
Facilities for cooking
Availability of supervisory personnel, etc.

The foods must have adequate packaging and shelf life. Convenience of use may be important; ideally, at the same time, the foods should not have special appeal which might promote diversion from the intended feeding programmes.

As food requirements rise with increase in extent and duration of an emergency, cost may become an increasingly important factor. Dry foods in lightweight packaging are preferable. Combination of factors in each situation may—especially when air transport is involved—determine what foods are, in fact, supplied, but there are certain guidelines that can be followed. There are literally thousands of processed food items in the markets of the world today. In general, operations will proceed more smoothly and effectively if the number of items involved is relatively low, but still allowing for adequate nutrition and offering reasonable variety. While the final list may be simple, the selection, if all the factors are properly considered, can be fairly complex.

Providing foods for localized shorter-term emergencies is often possible from national sources or from foods in storage or in transit in the area. This contribution to the symposium deals primarily with the main foods that might be supplied, particularly for young children, in larger-scale, longer-term emergencies.

As far as the basic traditional foods are concerned, most of what is summarized briefly here is covered in a 1967 publication of the Food and Agriculture Organization (Masefield, 1967). Special attention is given to recent experiences with newer mixtures which are especially useful in treating malnourished young children; some of these offer advantages in relief feeding in general.

Calories

It should always be borne in mind that fats provide 9 cal/g while carbohydrates and protein (when metabolized for energy) provide 4 cal/g. If necessary, fats can provide 50% or more of the calories but generally it will probably be better to aim at a level of 30 to 35%. In practice, the actual level consumed may vary due to uneven delivery of various foods and the preferences of the consumer.

In some areas certain oils such as olive

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or red palm oil may be preferred. In general, however, any of the common food oils such as soya, cottonseed, groundnut or maize are quite acceptable. Butter oil is currently available in large quantities; perhaps it could be mixed with other oils to improve acceptability, and possibly nutritional value, in certain countries.

The advantage of the relatively high caloric value of fats may be partially offset by a need to package in tins, thus increasing the weight to be transported, but there is still a net advantage.

Cereals will almost always be another major source of calories.

Whole grain cereals may be satisfactory but there should be assurance that there are local facilities at central, village, institutional or family level for whatever treatment of the cereal is necessary before consumption. Rice is often preferred but less available than other cereals. Bulgur (parboiled) wheat may also be acceptable. Wheat flour probably will not be used readily if there are limited local facilities for baking bread, making noodles, etc., and systems for their use. "Rolled wheat" may be useful.

Rolled oats, or oatmeal, is acceptable in many parts of the world but is generally less available than products from maize or wheat.

Maize is consumed in many countries as meal or flour. For some areas it is important to select according to color, hardness of kernel, etc. Refined heat-treated maize flour can be used in mixtures that are quite acceptable, as in the case of the US donation product CSM (fortified corn-soy-milk).

Sorghum and millets are important sources of food in many developing countries; central processing of these cereal grains flours for human food is increasing in both developed and developing countries. New varieties with more acceptable color characteristics and improved nutritional value are being developed.

Sucrose or other sugars can provide calories and also make certain foods more palatable.

Protein

Cereal grains provide considerable protein (rice -7%, maize and wheat -8–12%). Oat protein, at about 15%, rates high in both quantity and nutritional value. The protein in maize and wheat is deficient in certain amino acids and, especially in the case of rice, consumption of fats, sucrose, or tubers along with the cereal will bring the protein value of the diet below adequacy, particularly for children.

Grain legumes (beans, peas and lentils) are consumed in most parts of the world and are a vital complement to cereal grains, with respect to both quantity and quality of protein. As far as possible, grain legumes normally used in the area in distress should be provided. In the future, greater use may be made of fully or partially pre-cooked grain legumes.

In general, animal protein foods, with the exception of skim milk powder, may be difficult to supply in large scale, long term emergencies. However, it may be desirable to supply various types of dried fish; egg powder might also be useful.

Dried soups suitable to local tastes and formulated to provide protein (as well as vitamin and mineral supplementation) can be useful nutritionally and may provide welcome variety in the diet. They often carry considerable salt which may be scarce in the area and low in the other items of the diet, but on the other hand an excessive salt intake should be avoided.

Skim milk powder has for many years

been a standard item in routine feeding programmes and has been used in most emergency situations. In addition to protein, it provides vitamins and minerals. If an individual has not been consuming milk, it should be introduced into the diet *gradually*. The powder may be simply mixed with safe water to make a beverage, or it may be added to various other foods. In any case, if these practices are not known in the area, some instruction and supervision is necessary; without this the skim milk powder may go unused or be improperly used where its nutritive value is desperately needed.

At present, whole milk powder needs to be packed in gas-tight containers (usually tins are used) under nitrogen; thus, both the food and the package are relatively expensive. However, any supplies made available are likely to be welcomed and in at least some cases have been reserved for the most needy cases in hospitals, camps, etc.

Various forms of liquid milk preserved in tins have been popular in the tropics and have often been used in emergencies. Basically, they offer no special nutritional advantages over dried products and have the disadvantage of the increased weight per unit of milk solids.

Mixtures

Cereal based mixtures suited to local tastes offer a number of advantages. Lower cost vegetable protein concentrates, properly processed, can be part of the mixture. Vitamins and minerals can be added. Balanced mixtures of this type can be especially helpful in relief situations where delivery of various components of the diet may be irregular and where it may be difficult to arrange the feeding of the various components to each individual in appropriate proportions. Mixtures may be partially or fully precooked. A moderate amount of salt and some sugar, and, if desired, other flavoring materials may be added. Through the use of relatively stable ingredients such as full fat soy flour and/or added fat plus antioxidants, the fat content can be increased to levels between 5 and 10% thus increasing the caloric value and probably also the palatability.

Thousands of tons of a fortified corn (maize)–soy–milk mixture (CSM) provided through US Food Aid were distributed in India in 1967 and in Nigeria in the past two years. The acceptability has been reasonably good. New mixtures such as a fortified wheat-soy-blend (WSB), a precooked product based on high protein wheat fraction, soy flour, vitamins and minerals, are entering the international feeding programmes.

In the joint FAO/WHO/UNICEF programme on protein food, UNICEF has arranged for the preparation of prototype mixtures based on cereals or tubers and various protein concentrates. After biochemical and animal testing, these mixtures have been tested clinically in WHO sponsored centres. A number of countries are examining some of these mixtures for possible local production and distribution.

Protein rich supplementary weaning foods are in production and distribution in several countries, e.g. Bal-Ahar in India, "Incaparina" in Colombia and Central America, "Faffa" in Ethiopia and "Superamine" in Algeria (Milner, 1969). Projects involving similar mixtures are in various stages of development in India, Turkey, Taiwan, Iran, UAR, Tunisia and Madagascar. The availability of production facilities for such nutritious products in various parts of the world should be important to planning for relief feeding in the future. These

mixtures can benefit all age groups but are especially useful in meeting the needs of young children.

Feeding of infants and young children

Malnutrition, especially protein–calorie malnutrition in young children, common under normal conditions, may reach epidemic proportions when disaster strikes. Continuation of breast feeding is of the utmost importance but this may become impossible in some cases. Under the strains of the emergency an infant may have greater requirements for protein and calories; a crying baby needs more calories and possibly more protein than a calm baby. Almost inevitably there will be a collection of infants who are not yet severely malnourished but require artificial feeding. The most convenient food for the feeder will be the packaged complete formulations. Alternatively formulas can be prepared from whole milk powder plus carbohydrate or skim milk powder, carbohydrate and fat. Formulas based on vegetable protein are also available and will probably become more important in the future.

For treatment of protein-calorie malnutrition, it has long been known that certain cases may respond better if the lactose level of milk is reduced through the addition of casein and carbohydrate (King, 1966). Since January 1970, 300 tons of a mixture called "K-Mix-2;", consisting of casein 3 parts, skim milk powder 5 parts, and sucrose 10 parts (proportions by weight) has been very effective in the treatment of PCM in Nigeria. 100 g of K-Mix-2 and 60 g of food oil are mixed briskly; boiled and cooled water is added to reach the concentration desired. Almost all of the malnourished children have taken the preparation readily from a cup or spoon and the response has been excellent.

After some days of initiation of recovery on K-Mix-2, other foods can be introduced gradually. In Nigeria a modified form of CSM, "PKFM" (Post-Kwashiorkor Feeding Mixture) has been found especially useful for the transition. It is fully pre-cooked and needs only the addition of safe water prior to consumption; its composition is:

Corn (maize) flour	40%
Full fat soy flour	38%
Dry skim milk	5%
Sugar (sucrose)	15%
Vitamin-mineral mixture	2%
Added Vanilla flavour	

Dry PKFM contains 20% protein and 8% fat; it provides 113 calories per ounce (4 cal/g). It is readily accepted due to the sweetness of the sugar component, the fat level and the added flavouring. It requires no cooking and for feeding it needs only to be mixed directly with safe water. Fairly concentrated preparations may be fed, for example, 1 volume of the dry mixture to one and one-half volumes of water. In any case, adequate water intake must be maintained. Feeding with PKFM can be started at the rate of about one-half ounce of dry food per pound of the child's body weight per day (approximately 100 cal/kg of body weight per day). Thus a child weighing 20 pounds could be offered 10 ounces of dry product per day, prepared as a gruel, divided among 3 or more feedings. The amount fed may be increased or decreased in relation to the child's appetite and tolerance. PKFM may be used to supplement breast feeding, as a weaning food, or as a regular diet for all young children after weaning.

In the first half of 1970 UNCIEF supplied 850 tons of PKFM to Nigeria and in arranging to supply an additional 3 000 tons before the end of 1970.

The maize flour in PKFM is heat-treated

by a cooking-extrusion process before it is mixed with heat-treated full-fat soy flour and the other ingredients. Another approach to treatment of cereals or cereal/grain legume mixtures so as to reduce the need for cooking, to improve the flavor and to allow the preparation of more concentrated gruels is the treatment of starchy ingredients with amylase enzymes (Buffa, 1970).

Conclusions

In emergencies, the basic nutritional needs can be met through a relatively simple combination—cereal grains, tubers, fats and higher-protein foods. Infants deprived of breast milk require special attention. Modern food technology can make cereals more acceptable, nutritious and convenient to use. It can also provide new lower-cost protein concentrates. Nutritious mixtures which apply the newer cereal and protein technology have been found to be especially useful in the feeding of young children in recent emergencies.

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CALCULATIONS OF THE AMOUNTS OF DIFFERENT FOODS TO BE IMPORTED IN THE FAMINE AREA — EMERGENCY SUBSISTENCE LEVEL; TEMPORARY MAINTENANCE LEVEL

by G. B. Masefield[1]

The calculation of food imports into a famine area to sustain "emergency subsistence" and "temporary maintenance" levels of nutrition must start from some assumption as to what these levels are. The terms are themselves imprecise, and the supplies needed to maintain these levels will also vary with local climatic, demographic and other factors. We might for example assume that in the tropics, the environment where most of the serious famines of recent times have arisen, an emergency subsistence diet could be provided by food supplying 1 200 cal and 30 g of protein per caput per day. Such a supply might be expected to preserve life for at least 1 month, though some loss of body weight would have to be accepted and no serious output of work could be expected from the population. If this were the case, then the corresponding calorie requirements for a sub-tropical and a temperate country with their concomitant circumstances might be put at 1 440 and 1 525 cal respectively, though these average figures might well be reduced by 50 cal in the summer and increased by the same amount in the winter in these two climatic zones. The protein specification might be no greater by weight than in the tropics, especially if, as is to be expected in these zones, it were of better nutritional quality. A possible assumption for a temporary maintenance level of nutrition, capable of keeping a population alive for many months though with some loss of body weight, work output or both, might be for a tropical country 1 500 cal, which in facrt was the figure adopted in one area during the Nigerian civil war for its "minimal nutrition standard" (Mayer, 1969) and 40 g of protein. For sub-tropical and temperate areas corresponding figures would be 1 800 and 1 900 cal respectively, with the protein figure again possibly unchanged.

The kinds of food through which these figures are to be attained are not the subject of this paper, but two points may be noted as affecting the quantities to be imported. Firstly it is a waste of resources to provide expensive protein if a minimum calorie supply is not provided by other substances, since the proteins will simply be burned up to provide energy rather than perform their proper function. And secondly a certain proportion of calories, say 10–25 %, may conveniently be provided in the compact form of fat to save transport.

The proportion of the food, required to meet the nutritional target, which has to be imported may be either the whole or part of it. The former case is less common, and arises chiefly in the feeding of refugee groups, whether housed in camps or otherwise, who have no access to local food supplies. In this case a total diet has to be provided, and considerations in addition to

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calorie and protein requirements arise. Salt (NaCl) requirements are often stated as 10 g per caput per day in hot climates; under the emergency conditions we are considering, a minimum of 5 g should be aimed at. Medical supply requirements are likely under these conditions to include some more or less nutritional substances: for example glucose, saline solutions if rehydration of diarrhoea cases is to be practised, and perhaps iron compounds for treating anaemia. Special infant foods may need to be included in the food orders if none of the other foods ordered are suitable for infant feeding. But concentrated vitamin or mineral sources may not need to be considered in a short-term operation.

The other main factor to be considered in calculating food imports to provide a total diet is the waste to be expected. Wastage of food between purchase and ingestion is often globally estimated at 10%. Under famine conditions it is usually much less than this. But little information is available as to whether waste in the communal kitchens of a camp community is greater or less than in domestic kitchens. Perhaps it would be safest to allow for 5% waste in placing food orders. Waste, spillage and pilfering during transport also have to be allowed for in some famines.

By far the commonest famine situation is one where some food supplies, whether large or small, are locally available and imports are thus needed only to provide part of the diet. In these cases the quantities of locally available foodstuffs have to be estimated in order to calculate the balance which must be imported to make up the target aimed at. It is this estimation which is the most difficult, and requires the greatest effort, of all the calculations which are the subject of this paper.

The logical first step is to compile figures of food stocks held on commercial premises. This operation, which will involve many visits of inspection, is best carried out by officers of those departments of government which usually deal with trade and commercial matters. Although evasion and under-statement of stocks is to be expected, a reasonably accurate estimate of these food stocks should be possible to attain.

Potential food supplies from rural areas include, in the short term, stocks held on farms, supplies from crops already in the ground and livestock already born, and whatever supplies the population can be expected to derive from wild animals (this includes fisheries) and wild plants. The estimation of these will probably be undertaken by officials of the agricultural or other rural services of government. It is likely to be carried out by surveys of sample villages or farms to obtain such figures as food stocks, crop acreages, and livestock numbers which can later be multiplied by an appropriate factor to account for the whole area involved in the famine. This survey must generally be carried out quickly, and repeated at intervals. Too much time cannot be spent in devising elaborate sampling procedures and seeking an impossible statistical accuracy. It may be better to produce a quick estimate by surveying 20 villages than to spend time on attaining only slightly greater precision by surveying 100. Estimates made by calculating the calorie value of crops and wild plants avoid an error sometimes found in surveys of food consumption by households, which is to forget to include drinks as a source of nutrients; in some parts of Africa, for example, in normal times consumption of alcoholic liquors may provide as much as 10% of the calorie requirement, and much of this supply may persist even in famine.

Inaccurate as this estimate of short-term food supplies must be, it is still likely to be more correct than the estimate which has also to be made of longer-term agricultural production. Such attempts to read the future must be largely guess-work as to future crop plantings and yields, the supply of animal feeding-stuffs and so on. One can only suggest that such estimates be made by the most experienced agricultural officials, basing themselves on past records of production and taking all changes in the situation into account as best they can. It is in these estimates that the largest errors of prediction are likely to arise. Some of the commonest sources of error are that starving people may eat their seed supplies, weather may be abnormal, pests and diseases may attack crops, or agricultural implements and chemicals may be in short supply. In some famines, hungry people are tempted to eat their crops while still unripe, and the expected yield of food is thus reduced. Particular cases produce unusual sources of error. In the Nigerian civil war, agronomists on one side predicted an intensification of hunger by January 1969 because of an expected shortage of seed yams; in fact this did not happen, apparently because planting material passed through the fighting lines (Gans, 1969). Uncooked food issued as relief on one side in this war also passed through the lines to the other (Miller, 1970). General experience indicates that errors in the prediction of local food supplies tend in the direction of underestimation; in famine conditions, people usually seem to find more to eat than one expects.

When estimates of short-term and longer-term local food supplies have been completed as well as they can be, a balance can be worked out in calories and protein of the imported supply per caput necessary to complete, perhaps, the emergency subsistence target for the immediate period and the temporary maintenance level at a slightly later date. The relative requirement for calories and protein will depend mainly on the accustomed foods which are lacking, and is usually met to the greatest satisfaction of the people by replacing these with relief supplies which are as nearly as possible identical. To the nutritionist, however, this may merely mean perpetuating malnutrition which normally existed in the area. In the ordinary type of famine caused by crop failure, both calories and protein may be deficient by roughly the same percentages. Where famine is due to the cutting off of supplies by war, cases sometimes arise where it is protein-rich foods which are specially deficient.

In practice, the decision on supplies of foods to be imported will be made by considering the kinds of foodstuffs available and calculating, from the many tables of food values available, a combination of them which will satisfy the estimated deficits in calories and protein. The problem is to avoid under-provision of either of these factors in relation to the other. This is sometimes unnecessarily thought to be an arithmetically difficult calculation; it should be remembered that thousands of farmers in advanced countries who are not brilliant mathematicians make it regularly and with considerable accuracy in working out rations for their livestock. In any case the calculation of import orders will only need to be done by one or two people, who can be expected to be professionally qualified, at the headquarters of the relief service. They will also of course have to take into account in their calculations certain non-nutritional factors such as the price of different foodstuffs, their storage qualities, local processing and cooking facilities, and

if transport is limited the relative bulk of different commodities; however these affect not the quantity of food to be imported but its kind, which as mentioned already is not the subject of this paper.

So far we have been thinking in terms of food requirements per caput; the next stage in the calculation is to multiply these figures by the estimated population to be fed. This is another calculation which is extremely difficult and subject to much error. In some situations population estimates can be based on recent census figures or on records of numbers of taxpayers or households, if any of these are available. But under many kinds of famine conditions, such bases for calculation become quite unreliable. Populations may be swollen by an influx of refugees, or reduced if people have emigrated to regions where more food is available. In the Nigerian civil war, the loss of population by death varied in some areas from 4 to 10 times the normal mortality rate at different periods (Mayer, 1969); the birth rate was reduced by perhaps over a quarter (Aall, 1970). Normal figures for average numbers of persons in a household cannot be used if families are sheltering refugees. Total estimates of the population are difficult, and sample surveys not very useful, because conditions can vary so much from village to village or within other small areas.

Whatever orders for imported foodstuffs are decided on as the result of all these difficult calculations, it is certain that they must be frequently reviewed and that the level of supply must be constantly adjusted to meet changing conditions. Over-ordering must be avoided especially in the tropics where most foods will not keep for more than 3–4 months; but underordering may result in a gap in supplies should a shipment be delayed, and it is wise to keep at least 1 month's supply in store locally. Locally-produced foods may decline in quantity if the emergency becomes unexpectedly prolonged or more serious; or they may increase if, for example, weather conditions improve or if, in a shortage induced by war, the agricultural extension service succeeds in stimulating extra production. The population to be fed will vary by continued wandering of people, by the fall in the birth-rate if famine is prolonged, by the subtraction of deaths caused by starvation, disease or in some cases war casualties or by the addition of prisoners of war. It is indispensable for the estimation of future needs to keep food accounting records of amounts already issued in each locality; such records often help also to reveal true population figures or show where waste has occurred in over-supplying one area.

A further complication deriving from the calculations that have been suggested, is that although "per caput" figures may provide a gross basis for estimating the food imports needed, the nutritional requirements of individuals are not all identical. Although we are still considering the situation where some local food supplies are available, there will in fact in all famines be some individuals who do not have access to any of these supplies and will require a ration providing a total diet. Such individuals may include the sick, disabled, aged or simply the urban unemployed who have no money to buy food. A week after the end of the Nigerian civil war, it was estimated that, out of $1\,^1/_2$ million inhabitants of the former enclave needing relief, 300 000 required a total ration. People in this category, once discovered, can be re-identified for food distribution purposes by issuing them with special ration cards, or even as in Nigeria marking a thumbnail with silver

nitrate, and this also enables a record of their numbers to be maintained.

The case must also be considered of the nutritionally so-called "vulnerable groups", mainly sick people, children and pregnant and lactating women. In the Nigerian enclave, some field studies showed that 60% of those suffering malnutrition were children in the age group of 0–4 years. If the object of the feeding programme even at emergency subsistence or temporary maintenance levels is to preserve all lives, then some high-protein foods such as dried skimmed milk, dried egg powder, or soya-maize-milk mixture must be included in the import orders, at least for hospitalised cases of kwashiorkor, whose numbers are fairly easily ascertainable. For the remaining child population who are in their homes, the issue of special foods will be useless if they are likely to be eaten by other members of the family. It may be possible to distribute special foods for expectant and nursing mothers in long-term emergencies where the whole population has been registered for ration cards; but in emergency subsistence or temporary maintenance situations, such individuals are usually too difficult to locate. The estimation of their number is also often too difficult to justify firm orders for specific quantities of foods. It appears that we have very few figures of the percentages of pregnancies and lactations in whole populations. Dema (1965) found that in Nigeria the number of pregnant women as a percentage of the whole population varied from 1.0 to 3.2% in different villages, and those lactating from 6.6 to 16.2%. The latter figure will of course also vary between countries according to the customary length of breast-feeding, which in some parts of the world continues for 18–24 months.

After all these theoretical calculations, perhaps as a summing-up it is time that we looked at what they might represent in practical terms of actual foodstuffs. A daily per caput ration providing 1 200 cal and 30 g protein, the emergency subsistence level postulated for the tropics, and having some regard to probable prices and convenience of transport, would be approximately supplied by the following simple formula: cereal 260 g, dried fish 15 g, vegetable oil 28 g, salt 5 g. Within the general headings of this ration, items may be specified according to local needs or tastes, for example the "cereal" may consist of milled rice, whole maize grain, wheat flour etc. according to local processing and cooking facilities; the oil supplied might be olive oil, palm oil etc. according to local taste. A temporary maintenance ration providing 1 500 cal and 40 g protein with a slightly more varied diet would be approximately supplied by: cereal 300 g, pulses 25 g, canned meat 25 g, vegetable oil 30 g, sugar 10 g, salt 5 g. These formulae could provide for limited periods the total diet for a population having no access to other food supplies. In one class of these situations, such as refugee camps, where nutritionally vulnerable individuals can be identified, it will be very desirable to supply these, especially the children, with a supplement providing particularly more protein and some calcium and likely to consist therefore partly of dairy products with perhaps some legumes or another animal protein source; but the degree to which such supplementation is urgently needed to preserve life may depend on the previous nutritional history of the group. Where some supply of local food is available, the balance to be imported can only be worked out by the elaborate and error-prone estimations already detailed.

One further point has to be considered in

placing orders for food imports. The benefit of immediate importation of food has to be weighed against that of using the available funds and transport to import other articles which could reduce food demands. Tents, blankets and clothing, for example, by keeping people warm may reduce their calorie requirements. Other materials may be capable within a varying period of time of producing much more food than their own weight; into this class come seed supplies, fertilizers, agricultural and fishing equipment if these are lacking, and breeding stock of animals which multiply quickly such as rabbits. The degree of priority to be accorded to this class of imports will depend very largely on the expected length of the emergency, another estimation which is very difficult to make. In some famines other articles have been urgently requested by the relief services, for example weighing-machines to help determine the nutritional status of individuals or samples of the population and so enable food distribution to be more rational. There have been famine situations where the devotion of a very small amount of cargo space to text-books on nutrition and famine relief or to tables of food values could probably have saved life. In all these cases, it must be seriously considered whether the population at risk is not better served by limiting food imports to emergency subsistence or temporary maintenance levels for a little longer to enable the import of some of these materials than by utilising facilities to maximise immediate food imports.

Finally there is the problem, one of the most difficult in all famines, of phasing out relief at the end of the emergency as food supplies return to normal. At this stage it is almost impossible for the relief services to avoid one of two errors. On the one hand, there may be overprovision of food, which is wasteful of funds, can cause unfair economic competition with locally-produced food supplies, and may create a class of people dependent on free food and unwilling to work. On the other hand, there may be under-provision, which is particularly likely to cause hardship and distress to some unfortunately placed groups or individuals. The relief organisation cannot expect at this stage to avoid unpopularity and criticism; it should be satisfied if the volume of complaint on the two opposing grounds is about equal. The closing phases of the operation are likely to be a reversal of the stages by which it began; as commercial food supplies revive, relief food issues may be reduced from their peak level to temporary maintenance and then to emergency subsistence levels which are not likely to create dependence, and the last relief to be issued will probably be a dietary supplement to members of the vulnerable groups, and especially of high-protein foods to children.

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Rapporteur: Wenche Barth-Eide

Ifekwunigwe reported extensively on his experience with the use of K-Mix-II in nutritional rehabilitation of severely malnourished children, and presented data which showed the obvious advantages of this mixture compared with DSM, as measured by degree of hypoglycemia, incidence of diarrhoea and mortality rate. The high caloric density, suitability of gastric tube feeding and other characteristics make it very valuable in clinical work. Also it had proved to be excellent for field use, because it could be easily prepared and fed as gruel—which is the traditional way—and was well liked by the children because of its taste (in this case vanilla flavour).

Andersson described the attempt by the Swedish company Astra to produce an emergency food mixture that was easy to produce, store and transport and which therefore could be sent off after a few hours' notice. The mixture has as basic ingredients whole and refined wheat flour, FPC and iodized salt, to which oil and sugar could be added. It could be made into a porridge or a bread, leavened or unleavened according to local custom. The bread tried out by Astra had a protein calorie % of 17, available lysine 4g/16 g N and a PER value of probably about 2.4 (estimated on the basis of tests made on Iranian bread enriched with the same amount of FPC, which raised the PER from 1.2 to 2.4).

Whitehead hoped that the meeting would not become obsessed with proteins, as had been the case with most of the world for the last 20 years. He challenged the view that it would be desirable to have a protein calorie percentage as high as 18, as in the case of the Astra emergency food, unless the product was meant as a supplement. Even in clinical feeding there is seldom a need for such a high value, and the success with the special products in Nigeria was probably first of all due to the feeding scheme of 6 times per day. The point is to get enough calories in, otherwise the protein will be used for energy. Breast milk has an NDpCals% of about 7, and the protein requirement goes down after the first year of life. In the case of indigenous food mixtures, only very small amounts of beans or groundnuts or other protein sources are needed to enrich, for example, bananas, so that the NDpCals% is raised from about 3 to 7–8.

Vahlquist agreed with Whitehead and said that in some areas in Ethiopia inadequate amounts of calories were just as pronounced as lack of proteins in the age group $1\,^1/_2$ to 3 years. Ideally, therefore, special supplementary foods for this very vulnerable group should be specifically tailor-made according to the prevalent dietary situation. In practice, however, this is impossible, and that is why the production of low cost local weaning foods with a high protein content, and carrying vitamins and minerals at the same time, is now generally accepted. Admittedly, this may at times be a little luxurious.

Viteri reminded of the much higher requirements for some essential amino acids of infants than of older children. He therefore felt that there was a place for the specially high protein contents of these foods.

Malmros warned against the uncritical use of mixtures of any food ingredient available. For example, there might be reasons for choosing certain vegetable oils in preference to others to ensure an adequate supply of essential fatty acids.

Forman asked for a clearer distinction between relief measures in disaster situations and those required under more slowly developing famine conditions. He also advised not to confuse the issue by discussing foods for general use and food for therapeutic feeding at the same time, and was afraid of too much sophistication in the present discussion.

Teply answered that although the special mixtures he had mentioned—like K-II and PKFM—in the Nigerian situation had represented a small volume percentage of the total food provisions, it had played a very critical role in the treatment of severely malnourished children. *Annan* suggested that similar mixtures should be formulated on the basis of indigenous products with the help of local or foreign foundations. The enrichment of *garri* with some kind of protein would, for example, be highly desirable for Nigeria. In this way, one would no longer have to be dependent on im-

ported products like DSM, PKFM, etc., the provision of which might also, in fact, suddenly be interrupted.

Mellander pointed out that after all there is a close connection between the two types of foods that Forman had referred to. For instance, the production within Algeria of Superamine implies a level of preparedness in that country, not only for rehabilitation purposes but also for feeding pre-school children, which may be the most important thing in a disaster situation. The formulation and production of simple mixtures based on a staple along the lines that had been described by Andersson should therefore be encouraged.

Ramalingaswami drew attention to the need for protecting the young working adult. Where scarcity conditions develop and massive relief operations have not yet come in, families depend on the productive capacity of the working adult, who will soon get into difficulties if he cannot satisfy his energy needs. This was supported by *Viteri,* who was afraid that too much concentration on MCH services might imply that other important groups were forgotten.

FAMINE RELIEF

What kind of organization and what types of trained personnel are needed in the field?

by Jean Mayer[1]

In our life time, millions of men, women and children have died of starvation in gigantic famines—in Asia, Europe, Africa, Latin America—yet so little is ordinarily taught of the physiological, psychological and social problems of mass starvation and of their solutions that each new group of physicians and administrators who are called upon to deal with a new catastrophic situation tends to repeat some of the classic errors of omission and commission.

Causes of famine

Most recorded famines have been due to widespread failures of crops due to lack of water (droughts often followed by dust storms and loss of seeds), to destruction of crops by various types of diseases (such as fungus blights), or by pests (such as locusts), to disruption of farming operations due to wars and civil disturbances or to a combination of factors hitting both crops and farmers as a result of large natural disturbances (such as floods and earthquakes).

A melancholy testimonial to the frequency of famines of which records are available until 1950 is to be found in reference 1. Since then, a number of famines have occurred in India (floods, droughts), in the Middle East (locusts, earthquake), in China (floods, dislocation of agricultural system), in Latin America (earthquake including the recent Peruvian earthquake), and in Africa (droughts, Congolese civil war and finally Biafra).

Each of the four primary causes cited above is still operative. It is unfortunately reasonable to expect more famines. For example, if we examine the first and most frequent cause, drought, we may note that there are areas of Africa, South America, India and China (and for that matter North America and Australia) many square miles in extent where rains fail periodically. At such times, rainfall may be 80% less than the secular average. (By contrast, in Western Europe or New England, a dry year differs from a wet year by less than 20%.) Often these drought years alternate with years of flood where gigantic continental rivers, swollen by excessive rains in the mountains where they originate, burst their banks and destroy all crops.

In many of those areas of periodic failure, the situation has been made worse by erosion. The Middle East and North Africa are good examples: in the course of thousands of years extending from the dawn of civilization to the end of the Roman Empire, thousands of small and medium sized dams were built in that vast area which, together with Sicily, was the granary of Rome. With the decay of the Empire, in the course of the great Arab invasion, and finally through the ravages of Timurlane the dams were destroyed, the irrigation canals abandoned, and desert now covers that at one time had been some of the great cities of the world: the capital of Cyrus and Darius is now a mound of sand and the

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second largest theater in the Roman Empire stands in the Lybian desert as a reminder of how drought, erosion and famine can destroy seemingly permanent civilizations.

Whatever the primary natural cause of famine, it is made worse by lack of communication and by social inequality. Certain areas like that bordering the Sahara to the south or the Altiplane of Bolivia are particularly vulnerable to the former. All poor countries are examples of the latter. It may by useful to remind the reader that in as rich a country as Britain in 1935, with an average caloric intake of 2 000 cal, at least 10% of the population received insufficient calories, and the diet of 40% of the population was demonstrably too low in certain vitamins. Obviously, in a poor country like Egypt where biblical farming methods can be seen in operation five miles from the modern capital of Cairo, social inequalities are even much more acute.

Physiological and psychological effects of starvation

The first and most obvious effect of starvation is the wasting of fat deposits; both the subcutaneous adipose tissue and the deeper fat pads are affected. Abdominal and thoracic viscera are affected next; even the liver size is drastically diminished, the intestinal mucosa is thin, and smooth, loses some on its absorptive capacity with diarrhoe resulting. Gastric achlorydria is generally present; the heart shows a "brown atrophy" characteristic of starvation. Blood pressure falls; in some cases the systolic pressure becomes difficult to estimate, the diastolic pressure may be as low as 75 mmHg. The pulse rate may fall below 40 per minute. Edema generally occurs ("famine edema") as the amount of extracellular water does not decrease correspondingly as body weight decreases. Causes of famine edema are not yet clearly understood and may be multiple. They may include a disruption of osmotic tension in blood (plasma albumin is generally, though not invariably decreased), a fall in tissue and interstitial tension, due in turn perhaps to lack of elasticity of the skin (which becomes too big for its content), renal disturbances (nocturnal polyuria is a frequent effect of starvation) and endocrine disturbances (failure of male hormones, production and, conversely, deficient inactivation by the liver of estrogens and antidiuretic hormone). In women, amenorrhea, in males, impotence and loss of libido are early effects of starvation. Gynecomastia is seen in young males. Hair is dull and staring, and, in children abnormal "lanugo" hair grows on the forearms and the back. The skin acquires the consistency of paper: it is dull, grey, and inelastic and not infrequently shows the irreversible dusty brown splotches which are one of the permanent stigmata of starvation. In extreme cases, cancrum oris appears, destroys the lips and parts of the cheeks.

The psychological state deteriorates rapidly, the individual becoming obsessed with food, mentally restless, physically apathetic and self-centered to varying degrees —extremes being murder and cannibalism.

Decreased calorie requirements due to decreased body weight, decreased basal metabolic rate and decreased activity may eventually cause a plateauing of body weight. In a sense, one might say that "adaptation" to starvation is as much behavioral and social as it is physiological. A precarious equilibrium (a better description than "adaptation") may thus be created which can endure for several weeks or even months. The terminal events are usually intractable diarrhoea generally reported as in-

fectious but due to the fact that the gut has become essentially non-functional. Cardiovascular collapse can also occur. Infections also take their tolls of weakened organisms. In infants, progressive starvation is essentially similar to marasmus (2).

Social effects of famine

Obviously, the main and most immediate effect of a famine is, by definition, widespread deaths from starvation. The number of people dying from starvation is a good index of the severity of the famine—or conversely, the drop in such a number, an index of the effectiveness of the measures employed in combating the famine. It has been repeatedly observed that in famines old persons and young children die first, and that women and adolescents tend to survive better than men (though adolescents suffering from prolonged undernutrition are particularly susceptible to tuberculosis).

A second dangerous consequence of famine is the state of social disruption—including large scale panics—which generally accompanies it. An apparently general effect of a famine is that people who are starving at home tend to leave it if they can and march toward the area where food is rumored to be available. This increases the already prevailing chaos, families are separated and children are lost. Adolescents, finding themselves on their own, band themselves into foraging gangs which create additional disruption. The prolonged and successful practice of banditism makes members of these gangs difficult to rehabilitate. These social disruptions make any relief measure more difficult to put into effect. (Contrary to a prevalent belief, famines—and for that matter prolonged severe undernutrition—are rarely accompanied by revolution. Gravely underfed individuals are usually too feeble and too preoccupied with problems of immediate survival for themselves and their family to display the energy, single mindedness and organization necessary to mount a revolution. The type of disruption accompanying famine is more likely to entail a large number of unconnected antisocial acts, or at most, regional jacqueries. In turn, revolutions are more likely to take place when food has been again available for some time, but while the memory of the actual or supposed corruption or incompetence shown by the government in dealing with the famine is still fresh.)

Finally, a third common catastrophic result of famines is the spread of epidemics. The combination of physiologically weakened human organisms and of a disrupted social organism (with the attendant breakdown of public health installations and crowding) appears to lend itself to the explosive spread of infectious diseases. Traditionally, louse born typhus has been the great post-famine disease in Europe, cholera and smallpox the postfamine disease in Asia, though many other diseases, e.g. plague, influenza, tuberculosis, relapsing fever, etc. have also followed famine. When famine is due to a drought, malaria is not usually rampant at the same time, but is often deadly on a particularly large scale when the rains finally come.

Famine relief

The most immediate problem in a famine is to have a clear picture of the situation. With generally much of the structure of society broken down, with rumors flying—governmental sources generally minimizing the extent of the catastrophe and anti-governmental sources exaggerating it—

it is often difficult to know where the most pressing needs are and what the scale of the need is. Certification of causes of death may be incomplete and late. The most enfeebled persons—children and oldsters in particular—may be staying indoors so that the casual observer, seeing only ambulatory adolescents and young adults may not realize the scope of the disaster. All administrative, medical and social agencies must be utilized to gather and check statistical information. Hospital and other health agencies must be asked to report causes of death as fast as possible so that any increase in numbers of deaths due to starvation and the appearance of any deaths from epidemic infections can be detected early.

The basis of relief is to obtain and make available sufficient food to stop the developing famine, maintain the population in balance and eventually rehabilitate it. Table 1,—adapted from the excellent essay on famine in Passmore and Davidson's "Human Nutrition" (3) to which this writer acknowledges his indebtedness for a number of the ideas expressed in this article (ideas which unfortunately he was able to test repeatedly, the last time in Biafra in the Spring of 1969 (4, 5),—gives reasonable suggestions for the caloric ration permitting emergency subsistence, temporary maintenance as well as the generally agreed order of magnitude for the ideal allowances.

TABLE 1. *Caloric allowances in Famine Area*

Age, sex and occupation	Emergency subsistence[a] (calories)	Temporary maintenance[b] (calories)
0 to 2 years	1 000	1 000
3 to 5 years	1 250	1 500
6 to 9 years	1 500	1 750
10 to 17 years	2 000	2 500
Pregnant and nursing women	2 000	2 500
Normal consumers (sedentary)		
Male	1 900	2 200
Female	1 600	1 800
Moderate labor	2 000	2 500
Heavy labor	2 500	3 000
Very heavy labor	3 000	3 500

[a] This allowance would arrest the downward program of undernutrition leading to social disintegration and mass deaths.
[b] This allowance would not permit rapid recovery but would maintain the population in a reasonable state of health and permit slow recovery.

The procurement of this food requires not only its buying—or otherwise acquiring it on a governmental level—but its transportation, its safekeeping and its distribution. In spite of the efforts by some of the leaders of FAO, such as John Boyd Orr and André Mayer in the late forties, a World Food Bank or regional food banks for emergency situations have not yet come into existence. While there is thus no universal and automatic pathway for famine relief, the continued availability of large surpluses or cereals in the United States, Canada, France and other countries makes relief possible; but in spite of the creation of such national organizations as Food for Peace in the United States, the actual process of relief is often slow and cumbersome.

Distribution of available foods has historically been done through various methods. In the nineteenth century and the first half of the century, it was often attempted to improve the situation indirectly by making money available to the starving populace through public works projects conveying food to the merchants through the normal channels of trade. This policy, consistent with Adam Smith's laissez-faire philosophy, had had a moderate degree of success in local, foreseen shortages. It has failed miserably in large scale disasters such as the potato famine in Ireland or the

World War II Bengal famine. It helps least those groups—the very young and the very old—who are most vulnerable. It increases the energy expenditure of men involved in the public works not only through the caloric cost of manual labor but also because such works—usually road building—take place at some distance from their domicile. The work is rarely useful—roads lead "from nowhere in particular to nowhere in general"—as important public roads and other projects necessitate careful planning and can rarely be devised and executed properly on the spur of the moment.

In practice, distribution of commodities and public kitchens have proven most valuable, particularly if care is taken to allow such food to be doled out under supervised conditions to the patients too enfeebled to leave their homes.

Price control is an essential measure in any famine situation. It has to be vigorously enforced. Otherwise, high prices discriminate against the persons most in need. Furthermore, price inflation creates a motivation for traders to withhold food at what would be otherwise the end of a famine in the hope of perpetuating high prices.

The creation of a mass of small "famine hospitals" in large numbers, even though they may be staffed only with auxiliary personnel and medical students has proved to be invaluable in checking panic, vaccinating, delousing, disinfecting, and distributing insecticides, informing the administration and taking care of the greater number of the starving sick. The existence of a large but distant hospital is an invitation to migration and makes relief more difficult. The utmost attention must be given to prevent and check epidemics.

Finally, law and order have to be maintained so as to prevent looting and other abuses. This often means that the police units have to be given preferential treatment as regards food distribution.

Treatment of starvation

Any available, acceptable food is suitable in the treatment of cases where diarrhoea has not yet set up although bland foods and skimmed milk should be given during the first few days, preferably in small feeds. If these are taken well, the patient can progressively be allowed to eat as much as he or she wants. Intakes above 5 000 cal/day, with gains above 4 pounds a week have often been recorded with no apparent ill effects. If the patient is very enfeebled, and particularly if diarrhoea is present, bland feeds are a must. Skim milk is an ideal element of such a diet. Frequent small feeding of 100 ml at a time is a safe and effective way to use skim milk (skim milk powders are usually reconstituted to a 10 to 15% strength). Premature administration of foods such as canned meat and baked beans were responsible for the death of many of the World War II concentration camp inmates at their liberation. Fruit juices, glucose should be avoided as they are often the cause of intense discomfort. Slightly sour foods such as yoghurt or other curdled milks are usually well accepted and form a good intermediary between reconstituted skim milk and semisolid foods. If with refeeding edema gets worse, salt should be restricted as much as is convenient with the foods at hand.

If appetite remains poor in spite of the availability of food, and particularly if low blood pressure and diarrhoea persist, the prognosis is not good—intragastric feeding or intravenous feeding have then to be resorted to. While success does occur and may be spectacular, it is not frequent. It is important to remember also that many

treatments and drugs (such as antihelmintic) which are relatively harmless to normal patients, may the "the straw that breaks the camel's back" in a starving individual.

Political aspects of war famines

A letter of mine to the New York Times published earlier this year summarizes my views concerning the need for outlawing famines as an instrument of war (6). A comprehensive and scholarly discussion of the legal aspects of such a proposal has recently appeared (7).

"All men of good will recently applauded the action of our Government in signifying our intent to join other nations in outlawing chemical and bacteriological means of waging war. One strong argument leading to the President's action was that chemical and bacteriological warfare, the latter in particular, are indiscriminate in their effects and jeopardise civilian bystanders as much as they do armed enemies. I would like to propose that starvation be similarly outlawed as a legitimate instrument of war, on the ground that it is worse than indiscriminate, it preferentially attacks small children, pregnant and nursing women and the elderly. Now that the passions aroused by the Nigeria/Biafra conflict have abated, and the job of salvaging and rehabilitating the survivors of the worst famine in the post World War II period is going on may be an opportune time to make this proposal.

Starvation has been repeatedly defended by general staffs, including our own, as an effective military weapon. History does not bear out this assertion. The Union Armies beat Robert E. Lee in battle; the destruction of crops and barns by Sherman only succeeded in causing animosities which last to this day. Children died by the hundreds in the Siege of Paris during the Franco/Prussian war. But the French lost the war at Sedan, Metz, in the Loire Valley and on the Swiss Border, while the garrison of Paris held. The mortality due to malnutrition was high in Berlin and Vienna during the blockade of the Central Powers by the Allies during World War I, but the German armies never lacked abundant food. Children in Leningrad died by the tens of thousands during World War II, but the Red Army kept its food supply going and eventually the defenders broke out of the encirclement to link with the advancing relief task force. In Viet Nam, crop destruction and interdiction have not starved out the Viet Cong; they have increased the refugee problem and, to use current jargon, have been counter productive in efforts to win the hearts and minds of the villagers. The Nigerians overwhelmed the Biafrans with the weight of their numbers and imported arms rather than through starvation. Hunger was used as a weapon of terror by one side, of propaganda by the other, at the expense of millions of children, mothers and the aging. The facts are that young, adult men are physiologically the most resistant to starvation and that armed men never starve, particularly when they can justify their requisitions by the nobility of their cause.

An international agreement to outlaw starvation as a weapon of war should be supplemented by one empowering suitable international organizations such as UNICEF, FAO, or WHO to enter a famine area to feed the non-combatant victims of starvation without prior authorization of the belligerents. How many large scale disasters do we need before we learn that famine and pestilence are not purely 'internal problems'?" (6)

Personnel and organization

Obviously, the type of organization needed will depend on whether or not one is dealing with a war-caused famine; in that case, the organization will of necessity differ depending on whether the war is still going on, whether the front is in the middle of the famine area or whether the military situation is no longer a variable. I have expressed my views above on the urgency of an international agreement to set up an organization to deal with war related famines. It is important to note again that even in famines occurring in a single country in peace time, starvation causes intense political pressures: typically the opposition makes poor government planning the cause of the famine, government incompetence and corruption the cause of its continuation. Relief personnel, unlike more distant government authorities, discover themselves rapidly in the middle of a difficult argument, and find that they present the government side to the victims, while they vehemently take the victims' case to the government.

All this means only one thing: whether the famine is war-related or not, it is essential to have one man in charge of relief and he should be of high enough calibre to have the needed authority, nationally and internationally. His staff must reflect the complexity and the number of the problems which we have discussed in our brief review.

(a) *Intelligence.* We have made it clear that the rapid acquisition and analysis of information—death rates, hospital admission rates, numbers of persons in relief camps or at relief stations—is essential. This means that enough persons with *field* training in statistics and epidemiology are needed and that use must be made of medical and paramedical personnel, teachers, welfare and relief workers to keep the information up-to-date.

At the same time, economic information is equally essential: food stocks, prospects for harvest, rolling stock and trucks, fuel, repair shops, the state of roads and communications, money in private and government hands, prices need to be followed closely.

(*b*) *Medical and public health personnel.* We should emphasize the importance of obtaining personnel used to work under difficult field conditions, and to diagnose and treat those diseases which arise as the machinery of society breaks down (we have noted above the main epidemics most likely to follow a famine). One of the chief reasons why some experience of this type of problem is desirable, is that physicians in a famine often have to act in a manner very different from that instilled into them by years spent in "normal" hospital situations. Usually, the physician will concentrate on his more gravely ill patients first and then take care of his less affected patients. In a famine, and particularly in an epidemic, the goal is to keep alive as many as possible and this may mean that a severely limited amount of time and attention may be given to desperately ill patients. The physician will have to learn to delegate much heavier responsibilities to medical students, nurses or just intelligent laymen than he would normally do. Sanitarians must be given enough authority and means.

(*c*) *Food and nutrition personnel.* I shall not dwell on the obvious need for such personnel except to say that again practical experience and demonstrated imaginativeness in the field are essential. Some nutrition personnel should work closely with the medical personnel and with personnel trained in mass cookery. Others should

work with the planning staff, others with agricultural personnel.

(*d*) *Logistics and communication personnel.* Sooner or later transport becomes the limiting factor in relief. Maintenance personnel is as essential as logisticians and drivers; spare parts may have to have priority over food.

(*e*) *Economists.* We have already seen the need for economists in monitoring the famine (and the progress of relief). It goes without saying that while relief should never be exclusively directed by economists (to the exclusion of nutritionists and public health personnel), it is equally absurd to plan relief operations without considerable input from different types of economists.

(*f*) Personnel for liaison with civil authorities (the police in particular).

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Summary of Discussion

Rapporteur: Y. Hofvander

The discussion was opened by *Berg* who said we should face up to the fact that many relief efforts had not been as successful as they might have been. There were many reasons for this, perhaps the most important being that those administering relief programs often were not trained or equipped to do so. A relief operation mainly involves matters of management. We are talking about hundreds or thousands of ships, hundreds of millions of pounds of food and supply problems of a complexity that would challenge the most experienced administrators. Yet we find people who are medical specialists or food technology experts often tapped to conduct massive relief efforts and deal with problems of finance, logistics, and mobilization of large numbers of people. The general manager of Volvo would not dream of going into a physician's office and prescribing a medicine for a patient. For the same reasons we who are interested in some aspects of Food and Nutrition must recognize our limitations in management. Professional managers must be found and engaged. Relief programs often are of such magnitude and complexity that we can no longer afford to have them run by amateurs.

Mellander added that in his opinion, war is an extrapolation of administration and you can't expect that responsible people will listen to technical matters like nutrition and be convinced in times of war—if you have not been able to convince them in times of peace! In the UN family also most national delegations who take part in discussions on this matter are non-technical, i.e. non-professional. A recommendation should therefore also be made that in every national delegation the technical aspects should be covered by somebody who has experience in the field of nutrition.

Mathiesen agreed to Berg's claim that too many relief operations are run by "amateurs".

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He considered this to be due to the fact that governments had not taken the responsibility of operations and trained personnel. Up till now voluntary organizations working in the disaster relief field had drawn upon different types of personnel and among them also management personnel and other good leaders.

Forman brought up the question of training. There seems to be a need for trained personnel in the area of nutrition and operations in response to disaster. It would be a fairly easy task to organize an international training program if we could identify the need for people who are interested in this. US Aid which Forman represented, would certainly be pleased to sponsor such a training program in the relatively near future, e.g. in the summer of 1971. It would, however, first be required to reach a preliminary agreement above what type of training it would be, what the course should comprise and how long it would be, e.g. 4 or 8 weeks. SIDA's collaboration would be welcomed, or any other organization like the international organizations, alone or in collaboration.

Mathiesen underlined the importance of leadership training like that being done for instance by a firm in Santa Monica in the US, where leading personnel of civil defense are being trained, and also disaster relief operators. This is about the same type of training as the "war games" exercised by military staff. Such "paper training" could well be introduced in disaster manager training. Refresher courses would then be required once or twice a year.

Annan and other speakers endorsed the idea of pre-disaster training and rehearsal. Annan also proposed a university subject called "Administration of Emergency Aid". It was suggested by *Vahlquist* that the question of training be brought up at the workshop discussions and he hoped that recommendations for action would follow.

Aall agreed on the need for professionalism —but who is professional? It is much more than a question of being an expert, it is also a question of attitude and one of the most distressing experiences from the recent Nigerian/Biafran conflict was the lack of ability to adapt to a new situation. Also if one gets too dependent on modern technique in the form of aeroplanes and helicopters one gets so vulnerable so that when they break down, which they most often do in developing countries under these circumstances, there is a great risk of getting lost. It is not only a question of getting people with a military background and with experience in logistics working well in a modern army but also in making use of the vast experience of the UN bodies from their work in developing countries.

There would be a need for an international *advisory body* consisting of experts from FAO, WFP, WHO, UNICEF and others that is constantly accumulating experience and that could quickly assess a situation and estimate when there is need and what these needs are. Some of the members would have the specific task of recording during the actual operation for later evaluation in order to improve organization and operations in the future.

Reference was also made to the recommendations made by Aall in a recent publication (Aall, C.: Relief, nutrition and health problems in the Nigeria/Biafran war. *J. Trop. Ped.* Vol. 16, No. 2, pp. 69–90, 1970. Monograph No. 9) and it was suggested that these be included one way or other in the recommendations made by the symposium.

Vahlquist referred to the fact that most people at the symposium were probably painfully aware of the complexity of nutrition programs even in peace time. He welcomed a number of recommendations resulting from the symposium, ranging all the way from that proposed by Mayer in his presentation down to some more simple and practical proposals. For various reasons detailed recommendations for practical action could probably not be counted upon, possibly to the disappointment of the international and relief organizations who had come here. One of the recommendations, however, would have to be to work out some kind of manual similar to the one being worked out at present for the PAG on "home made weaning foods" by Cameron & Hofvander. It had been mentioned earlier that FAO was working on some kind of information sheets with respect to available food in various parts of the world at certain times. Perhaps the scope of that work could be broadened or a similar study made on a wider basis.

Annan returned to the need for training and rehearsal for emergency situations. Unless this is done—in about the same way as the army

does—there will be confusion, horror and emotional situations when disaster strikes. He also reminded that it is the responsibility of governments to move as quickly as possible to prevent food wastage in harbours where it often is locked up because of the stiff bureaucracy of customs clearances. Unless this red tape can be broken our efforts will be ineffective.

The need for *recording* was strongly emphasized by *Aykroyd* who had been the medical member of an Enquiry Commission after the great Bengal famine in India in 1943. The Commission spent months in Calcutta and elsewhere looking into the whole story of the famine and the various forces involved, including the part played by the war. It was a difficult task to unravel this tangled story and make clear-cut history of it. The government of India did not like the report and printed only a minimum number of copies. However, the report may have played some part in successfully dealing with the threatening next major famine in India in Bihar in 1967, which might have been as great a tragedy as that in 1943 if it had not been dealt with more effectively. This recording is of essential importance and a careful report on what had happened should be prepared by a competent group soon after the emergency had occurred.

Masefield made a plea for animals in disasters. There is in many famines a greater loss of large domestic animals than of humans. Animals serve to work for and provide man with food and therefore to protect animals is to protect man himself from famine. There is also a moral duty to other biological species. The death from starvation of, for instance, a beautiful race horse would cause intense grief to many people. The death of a cow might cause as much grief to a Hindu as the death of a human being. Therefore, if we were to press for an international convention denying famine as a weapon of war we ought to include the protection of animals as well. If human foods are to be allowed the right of free passage, animal foods should be allowed the same right. This would also enlist on the side of the proposed convention animal lovers all over the world who in many societies are a very strong section in public opinion. It is obvious that the right of free passage should be allowed not only for food but also for agricultural requisites, for instance ploughs and other equipment, fertilizers and the like. The absence of such essentials would cause starvation just as surely, if only more slowly, than the actual denial of food.

Mayer pointed out that we nowadays have a very much better understanding of the interrelationships between the various aspects of society but also that the very discussion we are having perhaps reflects the fact that over the development of time we have made discoveries in compassion as well as discoveries in technology. We should base ourselves on the fact that a great many things which have been tolerable in the course of human history are just no longer tolerable now. For many centuries starvation was essentially inevitable, largely because means of information and means of transportation were not at hand, and the fact that there always was some food somewhere else on the same or another continent was basically irrelevant. There was no way of bringing it there and distributing it. We now have the technology to transport the food to the area of famine. Therefore we have obligations which did not exist in past generations. We are now also in a much smaller world from which some of our contemporaries have stepped out to look at the space-ship on which we are all travelling. There is greater and greater realization that all human beings are born equal and are of equal value. We have not arrived there yet, however. We have recently been ignoring the fact that there is a famine in Yemen which appears to be fairly serious. If the famine had been in Holland instead we would all have been talking about it and a tremendous amount of action would have taken place. It is hoped that we shall soon have reached a stage where it will be essentially irrelevant where the famine is. This will require a considerable amount of education in compassion rather than in technology.

Mayer finally supported the idea of using modern technology in relief operations and particularly computers. The fact that famine often occurs in a remote area is no reason why we should not use computers and other modern technology. The very need for preparations on computer programs and coding and feeding into the computer in a certain way not only forces pre-preparedness but also obliges people to think of the various vari-

ables. One of the objects of a training course would be to start considerations of what sort of personnel are needed in a famine. Mayer could not think of any better way to turn swords into ploughshares than to use some top military personnel in relief work. This is something they can do quite well even if they have been prepared to do exactly the opposite. Even if a general does not know anything else—and often he doesn't—he does know to move a lot of material and equipment and personnel in difficult situations and in a great many different localities.

Recommendations

from a Symposium on

FAMINE

dealing with

NUTRITION AND RELIEF OPERATIONS IN TIMES OF DISASTER

held at Saltsjöbaden, Sweden,

August 24–27, 1970[1]

1. *International agreement on dealing with famine in conflicts*

Bacteriological warfare has been renounced through international conventions as a legitime instrument of war. One strong argument leading to this action is that bacteriological warfare is indiscriminate and may kill or harm civilian bystanders as much as armed enemies. Starvation should similarly be outlawed as a means of waging war on the ground that it is worse than indiscriminate, it preferentially affects children, pregnant women and nursing mothers and the elderly.

Yet in spite of their essential ineffectiveness as military tools, food blockade, destruction of crops and food stores and other methods directed at causing famines have been repeatedly employed in wars and other conflicts by large and small powers.

Great national catastrophies causing famine are difficult or impossible to prevent but the time has come when through international agreement and action man-created famines should be eliminated. The Symposium unanimously agreed to make the following

RECOMMENDATION

> Any use of starvation as a means of pressure or punishment against individuals, small or large population groups is a violation of the rights of man and should be outlawed.

The participants of the Symposium recommended that the hosts, the Swedish Nutrition Foundation and SIDA, should consult with the Swed-

[1] The *program* of the Symposium is given as App. I. The *organizations* represented at the Symposium are listed in App. II.

ish Foreign Office to explore the best ways to approach appropriate governments and international bodies to bring about a convention or modifications of existing conventions to outlaw starvation as an instrument in conflicts.

In as much as a definition of famine might serve as a guide for the purpose of drafting such a convention the following possible wording was suggested:

> "In any conflict, armed or not, the opposing parties must not prevent that food sufficient to prevent famine will be provided for all civilians.
>
> Famine can be defined as a severe food shortage accompanied by a significant increase in local or regional death rates. Among the signs of a famine are rapid increase in the prevalence of persons who are markedly underweight and/or have hunger oedema."

2. *International famine relief organization*

Experience has shown that a co-ordination of foreign and local assistance in famine relief operations is of vital importance and that there remains a great deal to be improved in this field. After discussing this the Symposium made the following

RECOMMENDATION

> UN agencies, international voluntary agencies and all interested nations should keep each other informed about their state of preparedness to meet disasters and to consider the preparation of plans for co-operation. The appointment of a co-ordinator for foreign aid at national level in all countries is of vital importance to the effective use of external assistance. If no co-ordinator is appointed the organization offering assistance should exchange information continuously on the development of the situation, the changes of needs and their plans and actions to meet them.
>
> It is also recommended that a permanent secretariat of an "international famine relief organization" be established, for instance within the office of the League of the Red Cross Societies. This secretariat should keep up to date records on available relief resources and continuously collect data which may be relevant to predict a possibly coming disaster. Further it is recommended the establishment of an advisory body consisting of experts from FAO, WHO, UNICEF, WFP, voluntary and other organizations with wide experience in this field. This advisory body should be "on call" for

rapid assessment of an impending disaster situation and for estimation when there would be a need and what these needs would be. Some of the members would have the specific task of recording during the ensuring operations for later evaluation of the efficiency of the operations.

3. *The creation of national disaster and famine relief organizations*

As a result of past experience it can be predicted with highest probability that disasters will continue to occur. The chief uncertainties are the nature, magnitude, timing, duration, and location. There has been a tendency to treat each disaster as a new and startling phenomenon. As a result there has often been a lack of preparedness and the relief efforts have been lacking efficiency and sense of direction. To minimize the tragedies brought on by disasters it is the responsibility of the governments to preserve the well-being of their people through effective, advanced planning. This can be brought about by well established and well functioning national relief organizations serving as co-ordinating bodies.

RECOMMENDATION

The Symposium strongly agreed that national relief co-ordination bodies with a permanent secretariat be established by the government at the highest possible level. The co-ordinator should be an influential person at permanent secretary level or above.

In countries where such organizations do not already exist it is recommended that the representatives of UN agencies in the country or region be ready to assist and advise in setting up of such a body.

The co-ordination body should establish close liaison with relevant ministries, voluntary agencies and so forth which may become involved in the combat against the disaster.

4. *The tasks of national disaster and famine relief organizations*

In the discussions on this point in the working groups a number of important duties for the national disaster and famine relief organizations were outlined. These referred to activities

before/during/after/a crisis

There emerged the following general

RECOMMENDATIONS

A. Before a crisis ("Peace-time" tasks)

I. To keep up-to-date data on *available* national *resources* for need and use in disaster.

II. To collect continuously data which may be relevant to *predict* a possible coming disaster and to analyse and interprete these data. The reports should not be construed to mean "no deficit" or "no casualty". This would include:

a) *Agricultural data* by regular (monthly) reports of agricultural extension and field workers on the condition of crops, factors that may prevent or have prevented planting and factors that may reduce yields seriously.

b) *Climatic data*—including drastic reduction or increase in rainfall.

c) *Health data*—including outbreaks of epidemics that may result in failure of crops (e.g. smallpox, yellow fever, cholera). Also reports on sudden rise in incidence of malnutrition and young child mortality.

d) *Localized disaster data*—including earth quakes, landslides, floods, etc.

e) Data on sudden and large *population movements* due to war, up-risings, calamities etc.

f) Data on sudden rise in *food prices*.

These data may be first signs of impending famine and reports to the national relief organization should be made on a continuous basis so that action may not be delayed by lack of information.

III. To serve as a *contact point* with other national and international bodies.

B. During a crisis

The special conditions due to disasters require special organization procedures and personnel. The prime requisites are for speedy actions and for *able, decisive leadership with high managerial skills.*

It is therefore recommended that governments should invest in a special officer (and related staff) the necessary responsibility and authority to direct the operation, to sequester personnel and resources and to make all necessary decisions relating to the relief effort (a "relief dictator").

In organizing available resources, governments should provide for co-ordinated and complementory functions of local governmental

agencies, voluntary agencies, and international organizations. Voluntary agencies, governmental and international bodies should be directly responsible to the plans and direction of the director of the relief effort, i.e. agencies directed to certain jobs or areas.

It should be recognized that a disaster subjects people to various and often interlinked hazards of hunger, thirst, disease, exposure, and social disruption. Accordingly, a relief effort should be conceived and conducted as a multi-faceted and co-ordinated operation. To avoid error and confusion, it is necessary that there be clear and common understanding of objectives and procedures. Therefore, while comprehensive planning requires a high degree of sophistication, communication and operational procedures should be simple and direct.

I. It is recommended that a *famine assessment and surveillance team* be set up if early or pre-famine conditions are suspected. The team should make uncomplicated yet unequivocally objective and clearly defined measurements in communities at risk under controlled conditions, so that the measurements can be repeated at regular intervals during surveillance if famine is found to be present. The assessment/surveillance team should be composed of observers selected by the National Central Agency. They could be either national or international staff, or both. They should not be directly involved in the actual feeding, so that their objectivity would not be impaired by personal involvement and time would be available for the task to be carried out properly.

Information should be sought from the community by house to house visiting, as well as from hospitals (and other health services) and from feeding centres.

The assessment/surveillance team would collect various measurements, depending on the type of malnutrition and the facilities available. These could include:

a) *Prevalence of malnutrition,* as judged by anthropometric measurements (e.g. weight, arm circumference), clinical signs (e.g. oedema), and possibly simple biochemical tests (e.g. serum albumin);
b) *Availability and consumption of food* among individuals of different age groups, as measured by intake of calories and critical nutrients;
c) *Prevalence of "conditioning" infections* (e.g. typhus, measles, etc.), which further decrease the nutritional and health status of

the population, and decrease the effectiveness of dietary therapy;

d) *Details concerning water supplies and environmental hygiene;*

e) *Shelter requirements against exposure,* current availability and requirements of shelter, clothes and blankets;

f) *Type and extent of social and economic disruption;*
extent of family disruption and possible methods of identification and tracing systems which would be required;
extent and possible uses of public information systems;
extent and possible uses of employment and welfare schemes;
availability, disruption and possible uses of market system, currency system etc.;
conditions of and need for public work programmes (roads, bridges etc.);

g) *Type of training and experience of personnel* locally available for relief activities.

It is recommended that a headquarter *analysis group* should be organized including experts in management, health, nutrition, agriculture and social sciences to collate, interprete the significance and relationships of all information, determine trends, develop priorities and predict future developments.

II. In organizing a famine relief it is recommended that the most efficient, economical and appropriate *feeding system* be introduced to deal with the particular local situation, as judged by the following considerations:

a) *General characteristics.* Foods used should, as far as possible be
from local (national) food supplies,
limited in number of items,
acceptable (in relation to food habits and religion),
easy to transport and store (long shelf-life),
nutritionally compact (e.g. high calorie and nutritive value per unit weight),
simple to distribute (if possible in pre-packed ration units, in dry form), and
wholly or partially pre-cooked;

b) *Types of foods.* These may be local or imported. They include:
general foods—often cereals, pulses (legumes), vegetable oil, sugar, preserved animal protein (e.g. dried sterilized milk, dried fish, canned meat), and salt;
special foods—for specific age-groups and needs, particularly specially formulated *weaning food mixtures* (e.g. C.S.M.), pow-

dered milk-based formulas for *artificial feeding,* and preparations designed for the treatment of *malnutrition* (e.g. KM-2 in the therapy of kwashiorkor etc., preferably packed with "giving set", including feeding tube);

supplements—vitamins and minerals really indicated by local need (often iron).

c) *Quantities*—Rations need to be established on the basis of nutrient requirements, so that needs can be assessed and local rations issued to priority groups selected in simple, easy-to-measure domestic units. Amounts will depend on decisions with regard to need for "emergency subsistence", "temporary maintenance", rehabilitation etc.

d) *Priority categories.* Selective distribution will usually need to be undertaken, unless the resources permit the whole population to be fed. A system of selection will need to be decided on, based on various appropriate uncomplicated techniques (e.g. weight, age, circumference.) Often distribution techniques may only be practical on a family basis. Distribution must be based on the priority of certain groups:

physiologically vulnerable (e.g. young children, lactating and pregnant women, the aged, the sick);

the main work-force—whose efforts will be needed for future food production etc;

the relief and administrative personnel (e.g. police etc.);

e) *Preparation and distribution.* There must be great flexibility, so that foods are distributed according to the local situation (e.g. needs, type of disaster and availability of resources).

Different amounts and types of rations will be needed for different priority groups, and different feeding schemes may be indicated (e.g. several meals/day, one meal daily, weekly feeding etc.). Preferably foods should be distributed without prior communal preparation. Under certain circumstances, food should be communably cooked or prepared before distribution, and sometimes consumed on the spot:

if foods need qualitative selective distribution;

if an imported food needs special preparation to be locally acceptable;

if there is a risk of the food not reaching the particular group intended or being deviated to the black market.

Special equipment may be needed for the preparation of the food, and should accompany it for use in central kitchens or in family-level cooking, as needed for the local situation. The hygiene of food preparation and the need for adequate clean water supplies are important. A field adviser (in diet and nutrition) on the preparation of food supplies is highly desirable.

III. A concurrent *assessment system* should be developed, independent of other operational responsibilities to test the efficiency of information gathering systems and the efficiency of action activities in order to immediately revise current operational procedures.

C. After a crisis

It is recommended that *rehabilitation of the affected area* be planned from the initial stages of famine operation onward, and should include the return of displaced persons (first to their families, eventually to their home), the restoration of agriculture and food production, of schools, health, hygiene, nutrition, and other social services, and of housing and communications (including roads). These activities would be undertaken by the government, with international assistance whenever needed. Local staff will have to be trained to take over the operation progressively. Rehabilitation should be undertaken gradually, in planned phases, and should be initiated when indicated by findings of surveillance teams.

It is recommended that *analysis* of the *causative factors and the effectiveness of methods* of prevention and relief should be undertaken following every disaster. The results are of the greatest importance nationally to prevent recurrence and internationally to guide future aid and assistance.

5. *Training*

RECOMMENDATION

It is recommended that workshops arranged by an international organization should be held to train persons who would then conduct training courses in their own countries. It would be desirable to arrange these workshops on a regional basis.

It is further recommended that each country should train a cadre of personnel who would remain in their normal jobs but be available for disaster and famine relief work.

6. *Manual*

RECOMMENDATION

It is recommended that a suitable Manual be prepared for the guidance of Governments and to Relief Agencies, both to guide relief activities and to facilitate training.

This Manual (which would be a loose leaf handbook) should be based on recent experience and continually brought up to date. It should give general principles (supplemented by local notes adapted to the local area).

Program

Symposium on

FAMINE

dealing with

NUTRITION AND RELIEF OPERATIONS IN TIMES OF DISASTER

Saltsjöbaden, Sweden,

August 24–27, 1970

Monday, August 24

Introduction

B. Nicol, FAO, Rome, Italy: Causes of famine in the past and in the future.

W. R. Aykroyd, Oxford, England: Definition of different degrees of starvation.

EFFECTS OF STARVATION

The individual

F. E. Viteri, INCAP, Guatemala: Effects on body composition and body function. Psychological effects.

R. G. Whitehead, Child Nutrition Unit, Kampala, Uganda: Causes and effects of protein calorie malnutrition. Physiology and pathology consequences, reversibility of PCM, vulnerable groups.

The family and the society

D. B. Jelliffe, Carribean Food and Nutrition Institute, Kingston, Jamaica: Effects on the function of the family.

W. Foege, Department of Health, Education and Welfare, Atlanta, Georgia, USA: Famine, infections and epidemics.

FAMINE RELIEF

Rehabilitation in individuals

F. Mönckeberg, School of Medicine, Santiago, Chile: Refeeding and medical care.

J. M. Bengoa, WHO, Geneva: Nutritional rehabilitation of malnourished children under emergency conditions.

Tuesday, August 25

Recent field experiences

R. Passmore, Department of Physiology, Edinburgh, Scotland: Introduction.

V. Ramalingaswami, AIIMS, New Delhi, India: India.

A. Omololu, University of Ibadan, Nigeria: Nigeria.

A. E. Ifekwunigve, Okpuru, Nigeria: Nigeria.

A. Jabra, UNRWA, Beirut, Lebanon: Palestine arab refugee work.

Relief programs

L. J. Teply, UNICEF, New York, USA: What kind of foods should primarily be provided, particularly for young children, in famine?

G. B. Masefield, Department of Agricultural Sciences, Oxford, England: Calculations of the amounts of different foods to be imported in the famine area. Emergency subsistence level: temporary maintenance level.

J. Mayer, Harvard University, Boston, USA: What kind of organization and what types of trained personnel are needed in the field?

Wednesday, August 26

Workshops

Group I

Moderator: *Jean Mayer*

Secretary: *Yngve Hofvander*

Group II

Moderator: *Alan Berg*

Secretary: *Gunnar Almgård*

Group III

Moderator: *D. B. Jelliffe*

Secretary: *Wenche Barth-Eide*

Thursday, August 27

Presentation of reports from the work shops.

General discussion, conclusions and recommendations.

In addition to the introductory speakers also representatives of a considerable number of International and National Organizations (see App. II) were present on invitation. Thus, opportunity was provided for a broad contact and a lively exchange of ideas between nutrition scientists and relief workers, with experience from the field well represented on both sides.

The following organizations were represented at the Symposium

International organizations

Food and Agriculture Organization (FAO)
World Health Organization (WHO)
United Nations Childrens Fund (UNICEF)
United Nations Relief and Works Agency (UNRWA)
World Food Program (WFP)
Catholic Relief Services
International Paediatric Association
International Red Cross Committee
International Union for Child Welfare
League of Red Cross Societies
Lutheran World Federation
Oxfam
Save the Children Fund
World Council of Churches

National organizations

Norwegian Agency for International Development (NORAD)
Swedish International Development Authority (SIDA)
Swedish National Board of Health and Welfare
Swedish Association of Food Technology
Swedish Board for Technical Development
Swedish Red Cross Society
Swedish Save the Children Federation (Rädda Barnen)
US Agency for International Development (USAID)

SYMPOSIA OF THE SWEDISH NUTRITION FOUNDATION

I. Mild-Moderate Forms of Protein-Calorie Malnutrition. 1962. 159 pp. Price Sw. kr. 35.—

II. Occurrence, Causes and Prevention of Overnutrition. 1963. 152 pp. Price Sw. kr. 35.—

III. Nutrition and Caries-Prevention. 1964. 130 pp. Price Sw. kr. 35.—

IV. Polyunsaturated Fatty Acids as Nutrients. 1965. 86 pp. Price Sw. kr. 28.—

V. Nutrition and Physical Activity. 1966. 143 pp. Price Sw. kr. 40.—

VI. Occurrence, Causes and Prevention of Nutritional Anaemias. 1967. 184 pp. Price Sw. kr. 45.—

VII. Nutrition in Preschool and School Age. 1969. 154 pp. Price Sw. kr. 45.—

VIII. Food Cultism and Nutrition Quackery. 1970. 103 pp. Price Sw. kr. 35.—

IX. FAMINE. A Symposium dealing with Nutrition and Relief Operations in Times of Disaster. 1971. 200 pp. Price Sw. kr. 50.—

Price Sw. kr. 50.—